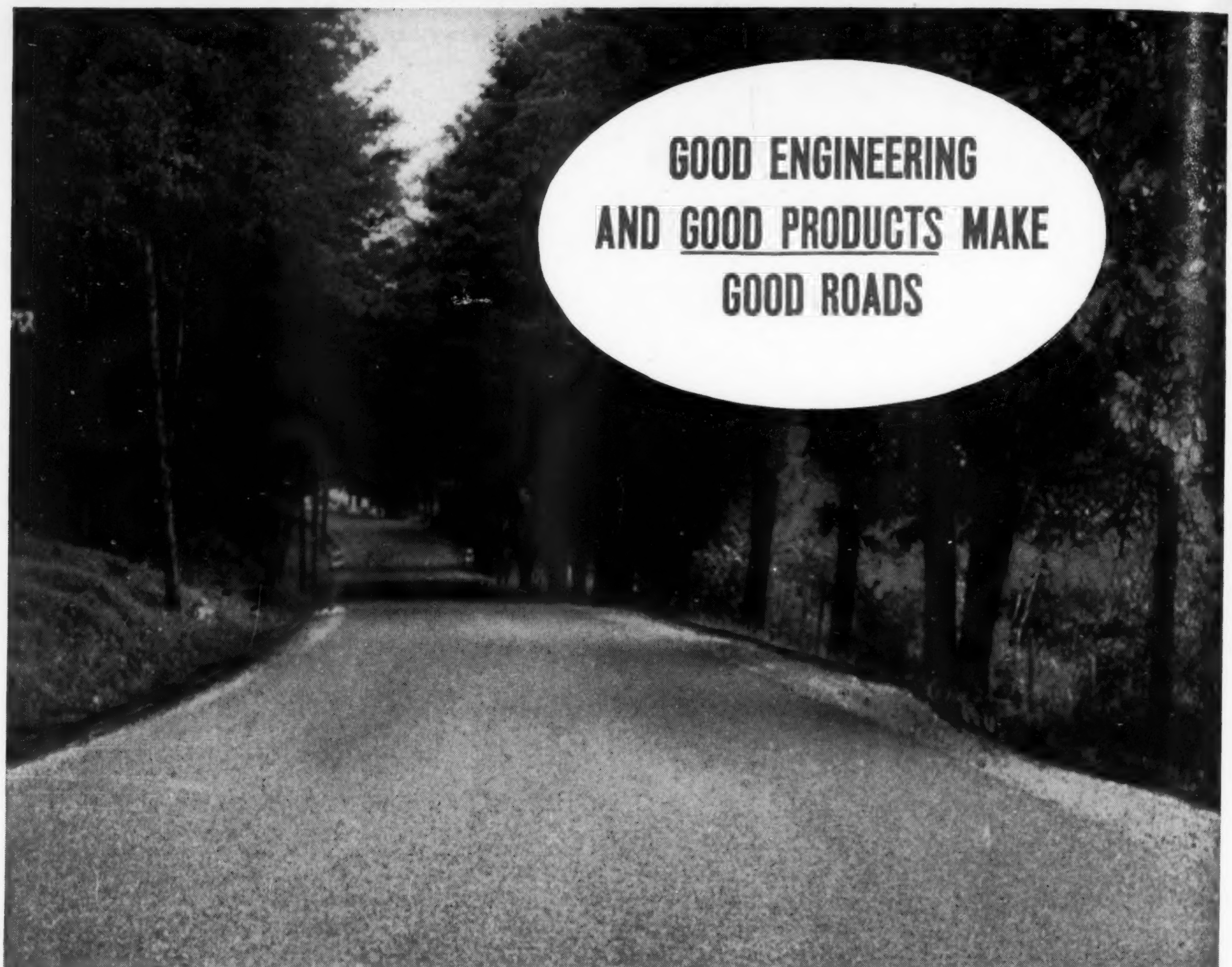
PUBLIC WORKS

City, County and State

The plowing of snow from sidewalks by the city is a service greatly appreciated by the citizens.

OCTOBER, 1936



Socony R. C. No. 3 mixed in place, Standard Brand, Guilford Road near Brattleboro, Vt.

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OCTOBER, 1936

PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

OCTOBER, 1936

VOL. 67, NO. 10

Contents

TIMEWASTERS

Fast Work:

The *Link-Belt News* runs some fine Timewasters, and this one is borrowed with thanks from that publication: "A male and a female microbe were put into a quart bottle. So rapid was the process of reproduction, that the microbes doubled in number each minute. The bottle was full in 6 hours. When was it half full?" This was contributed by *Mr. Unruh.*

How Old Are John, James, Jerome, Jacob and Joseph?

A man had five sons as above, the eldest being John and the youngest Joseph, with the others in the order given. The sum of the ages of John and Joseph is 48. When John was twice the age Joseph is now, his age was two-thirds the combined ages of James, Jerome and Jacob, whereas he is now one-half the combined ages of James, Jerome and Jacob. How old are the boys?

Who Can Horn In On This?

The above man had a herd of dairy cows, which he wished to dispose of in his will. To John he left half of his herd plus half a cow; to James one-half of the remainder plus half a cow; to Jacob one-half of the remainder plus half a cow; to Joseph one-half of the remainder plus half a cow; and to the local church the remaining single cow in his flock. He added a proviso that none of the cows should be injured in the process of division. How were the cows divided and how many did each son get?

A Message to Our Readers

This season of the year is particularly difficult for the proprietor of this column, as he is away from the office frequently and finds it difficult to prepare the material under such conditions. He will do his best to keep a few problems on hand, and will appreciate greatly any assistance in the way of contributions from those interested in Timewasters. Solutions to the problems in the September issue will be published as soon as time is at hand to check the answers supplied.

W. A. H.

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A. PRESCOTT FOLWELL, Editor — **W. A. HARDENBERGH**, Asso. Editor

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Vol. 67 | *October, 1936* | No. 10

Operation of Separate Sludge Digestion Plants

By W. W. TOWNE,

Director, Div. of Sanitary Engineering, S. Dakota Board of Health

THE purpose of the mechanically cleaned settling tank and the separate sludge digestion tank is two-fold, namely: the removal, in the tank, of those suspended solids that will settle from the liquid while it is passing through, and the reduction, in the digester, of the organic material contained in these solids, by bacterial action, to substances largely inorganic which may be disposed of without creating a nuisance or health hazard. Another purpose or reason for mechanical cleaning of the clarifier is to facilitate removal of the settled solids to the digester before septic action takes place.

Because such treatment units involve the use of mechanical equipment they require closer supervision then do Imhoff tanks, which are designed to accomplish the same general purpose in the sewage treatment process.

The Settling Tank

Mechanically cleaned settling tanks have in the bottom of the tank a slow moving, scraping mechanism. This moves the settled solids to a low point, or sump, in the tank, from where they may be removed by pump or gravity to the digester. Most units also have some device at the surface which moves the floating material to an outlet apart from the tank effluent. This latter device is operated intermittently as necessity demands, and the sludge scraping mechanism may be operated either intermittently or continuously.

The chief points in the efficient operation of such a unit are:

1. *Sludge Removal.* Fresh sludge should be removed as often as is necessary to prevent septic action in the tanks. This is advisable as an aid both to sludge digestion and to more efficient removal of suspended solids. The evolution of gas from septic sewage with rising gas bubbles disturbs the settled material and carries it to the surface thus interfering with sedimentation of incoming sewage. Sludge, as added to the digester, should be as fresh as possible in order that it may start its digestion cycle under proper conditions for favorable digestion.

During periods of sludge withdrawal the sludge valve should be opened only as long as a dense sludge continues to flow. Continuing withdrawal after this will only increase the quantity of liquid in the digester with a consequent increase in return sludge liquor to the clarifier. Also sludge withdrawals should be at such a rate as to inhibit the formation of channels or cones in the outlet pipe whereby the clarifier liquid can pass out the sludge pipe before the sludge is removed.

On the discharge pipes of the sludge pumps there should be sampling valves whereby samples of sludge may be collected during pumping.

2. *Scum and Grease.* Depending upon the type of sewage, there may be more or less accumulation of

Courtesy the Dorr Company

Grand Rapids, Michigan, treatment plant. Sludge dig esters in the foreground, clarifiers in the background.

grease on the surface of the tank. This should be removed at frequent intervals before its thickness increases to sufficient depth to extend below the outlet baffle and before septic action occurs. Such an accumulation will also tend to hold material at the surface which would otherwise settle. It should be removed at least twice daily and more often when necessary.

3. *Inlets.* Where the inflow is over a weir from a channel, heavy solids will accumulate in the bottom of the channel. These should be stirred or broken so that they will pass into the tank. Weir inlets, for this reason, are not so satisfactory as ports or openings in the sides or bottom of the inlet channel.

4. *Outlets.* Outlet weirs should be kept clean and should be maintained at the same elevation throughout their entire length.

5. *Scraper Mechanism.* The tank should be drawn down at sufficient intervals to permit adequate knowledge of the condition of the sludge scraper mechanism, and new parts installed when necessary. It is the effective operation of this mechanism that warrants the increased cost for mechanical equipment, therefore, its parts should be kept in repair, and lubrication attended to faithfully.

6. *Painting.* All mechanical clarifiers have metal parts in a corrosive liquid (sewage). Frequent painting, with proper paint, is a good investment.

Separate Sludge Digestion Tanks

Separate sludge digestion tanks are usually rather deep (20 feet or more) with a gas tight roof (stationary or floating) and may contain a mechanically driven stirring and sludge-scraping mechanism. These tanks also have a sludge outlet at a low point or sump in the floor. The purpose of the mechanism is to mix the fresh with seeded sludge, to move the digested sludge at the bottom toward the outlet when sludge is withdrawn onto sludge drying beds, and to break up any scum or floating material at the surface. In those tanks not having stirring mechanism, the mixing may be accomplished by recirculating with sludge pumps, in addition to that caused by the evolution and rising of gas particles. Convection currents also may cause some mixing.

Separate digestion tanks are usually heated by circulating hot water through pipe coils hung on the inside of the tank wall. Sufficient fuel for heating the water can usually be obtained by collecting and burning the gas generated during digestion of sewage solids.

The chief operation problems of separate digestion tanks are:

1. *Temperature Control.* The temperature within the tank should be maintained at approximately 90° to 95° F. Some operators and engineers favor a slightly lower temperature. At several plants in the Midwest it has been found by experience that the dropping of the temperature to 80° or 85° F. tends to increase foaming and scum formation.

2. *Daily Addition of Fresh Sludge.* The amount of fresh sludge that can be added to a digestion tank without disturbing the favorable chemical and biological balance depends upon the quantity of digested or seeded sludge present in the tank and the digestion temperature. It is rarely advisable to add fresh sludge in excess of 5 per cent of the total sludge content of the tank, and it is better if the fresh sludge addition amounts to only 3 per cent of the total sludge volume in the tank. These figures are based on the dry solids content of the sludges.

3. *Return Sludge Liquors.* In practically all separate sludge digestion plants the supernatant liquor from the digester is returned to the inlet of the settling tank. This liquor is high in organic content and the quantity returned should be maintained at a minimum. The amount returned is approximately equal to the daily addition of fresh sludge, for which reason it is advisable to pump only the most dense fresh sludge to the digester. The line of demarcation between the supernatant liquor and the sludge will vary, depending upon several factors. With outlets at various depths, it is possible to withdraw a sludge liquor from that depth where there is the least amount of solids. In floating-cover digesters, sludge liquor should be withdrawn just previous to adding fresh sludge.

During periods of foaming, or when the return sludge liquor contains excessive amounts of solids, the addition of lime to the liquor before it enters the clarifier may assist in its sedimentation and will reduce septic action.

4. *Gas Collection System.* The gas collection dome located in the roof of the digester may fill with scum and foaming sludge. A water spray located in the dome will assist in keeping down the level of this material. The water seal on the gas dome should be replaced with an anti-freeze during the winter months. Gas piping from the gas dome to the control house or boiler room should be laid below the frost line and should not have any pockets; or if pockets are necessary, traps and bleeders should be put in to remove the water forming from condensation.

5. *Hot Water System.* The total area of the heating coils should be such that the desired sludge temperature can be maintained with a water temperature not exceeding 140° F. Higher water temperatures may cause a caking of sludge on the outside of the coils. Where such caking exists the same should be removed when it is noted that the temperature of the recirculating water must be abnormally high to maintain the desired tank temperature.

Gas from digesters contains considerable sulphur which accumulates on the outside of the boiler water tubes forming a hard scale, thereby decreasing their efficiency. By cutting the boiler out of service and running water over the tubes this scale will be dissolved and the boiler returned to its original condition.

6. *Sludge Withdrawal.* Digested sludge should be withdrawn in small amounts at frequent intervals rather than large amounts at infrequent intervals. Sufficient well seeded sludge should remain in the tank to maintain the proper ratio between daily additions of fresh sludge and seeded sludge.

7. *Scum Formation.* Certain types of sewages are conducive to the formation of a sludge which tends to form a floating scum in the digester. Where such conditions exist and where this scum will not resettle, it is advisable to make an extensive survey regarding the type of material and methods for its elimination before reaching the digester. Such material is often low in organic content, such as cow paunch, and may be removed by fine screens at the source of production.

8. *Foaming.* Foaming of sludge in digesters may result from many causes. The addition of lime may or may not be a remedy. In case of starting new plants or where the pH is quite low, the addition of lime will often reduce the foaming period. When lime is added, however, sufficient amounts should be added at one time to raise the pH to 7.2 or 7.4. The addition of an equal amount over a period of several days will usually not accomplish the same results, as no material increase in the pH value will occur. The addition of excessive amounts of fresh sludge may also cause foaming and in this case an increase in temperature up to 95° F. may be of assistance by hastening digestion. Also, during such a period no digested sludge should be withdrawn.

Close-up of finished surface before seal is applied

Low Cost Surface Treatments in Alabama

By LEON GOTTLIEB
Bituminous Engineer, Alabama State Highway Department

OUR experience with surface treatments is leading us to a completely different conception of highway design, in that instead of designing the pavement to carry the load as well as to resist abrasion and moisture, this load-supporting function is taken care of almost in its entirety by the base or the subgrade itself after appropriate treatment. When this is done, the function of surfacing is purely to take wear and tear of traffic and to waterproof and protect the foundation. The traffic capacity of a bituminous mat depends largely on the quality of the base on which it is placed.

In the past it has been common practice to construct low-cost surfaces on poor bases; and although some thought there was justification for this, it certainly should not be done any more, as it is believed that at least 80% of road failures are failures of the foundation. Bituminous mats frequently have been placed on low and poorly drained grades, and this directly invites failure and high maintenance costs. Surface failures also occur when bituminous mats are placed on clay soil bases, which lose their supporting ability when wet.

Where well-designed surface treatments are placed on stable, well-drained bases that are not subject to capillary action of water, with proper maintenance, the traffic capacity should be equal to that of most of our higher type pavements.

With a satisfactory subgrade and a base of selected local sand-clay or gravel placed so as to give at least a 6-inch compacted base, a low-cost road of the surface treatment type can be built successfully. Good drainage is essential and the ideal condition is one where the subgrade material is of a sandy nature. Wherever possible, the compaction produced by years of traffic on the old road should not be disturbed. It is better to add new base-course material to bring the existing road to the proper shape, than to scarify it in order to shape same. In most places local material can be used for the construction of the base course.

Our present specifications for sand-clay or top soil is that the material passing the 10-mesh sieve shall meet the following requirements:

	Percentage passing by weight
Clay	9 to 18
Silt	0 to 15
Total sand	67 to 91
Sand retained on 60-mesh sieve	45 to 60

When gravel is used the material must meet the following requirements:

Total passing	*Percentage by weight*
2-inch sieve	100
1½-inch sieve	80 to 100
No. 4 sieve	35 to 80
No. 10 sieve	30 to 70

Material passing 10-mesh sieve, classed as binder, shall conform to the following:

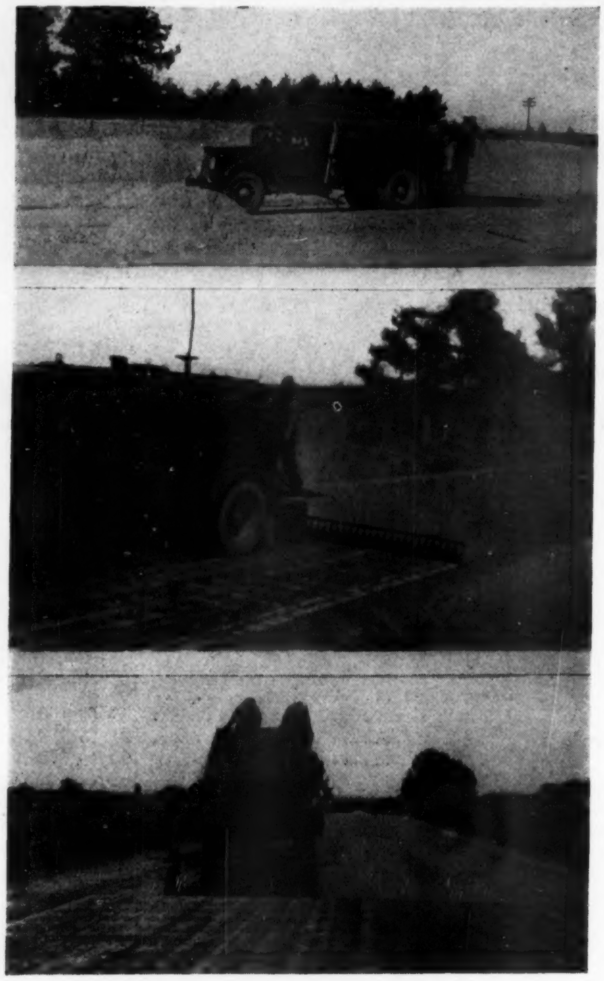
	Percentage by weight
Clay	9 to 20
Silt	0 to 15
Total sand	65 to 91
Sand retained on 60-mesh sieve	45 to 85

As a general rule, chert is not used, although occasionally we find a chert sufficiently good in quality to be used. At present the only safe test to use for determining the quality of chert is the soil test. If the chert has a liquid limit of less than 25 and a plastic index of less than 6, it is satisfactory for use in the base course. If the chert does not meet these requirements, it needs stone to give the chert some "body" and fine sand or screenings to reduce the plastic index. Usually this procedure is too expensive for low-cost work. Local materials having a low clay content with well graded sand and silt usually make the best bases.

The selection of base course material pits should be made far enough in advance of their need, so that sufficient tests can be made of the material to determine whether or not it is satisfactory for use in the work proposed. Many local material pits contain streaks and pockets of unsuitable material, so that proper inspection is necessary for the selection of suitable material.

Base course material should be spread to the proper grade, line and cross section when placed, and then every effort should be made to maintain it to as near the true section as construction methods will permit. Bases will be better compacted and require less work before priming if constructed properly from the start. Before priming, the base course material should have the designated thickness, meet gradation requirements, be satisfactorily campacted, have good riding qualities and be free from laminations. It should be checked with a templet to see that it conforms to the required cross section so that the road will drain properly. At present we are using a straight line crown of ⅓ inch per foot with the shoulders cut to ¾ inch per foot fall.

Selection of good shoulder material is very esesntial. The shoulders should be built along with the base course



Top—Applying tar prime with 525-gal. State owned Kinney pressure distributor. Middle—Applying hot asphalt on cotton fabrics. Bottom—Distributing aggregate cover on hot asphalt

and should be struck off and held slightly below the elevation of the finished base course at the edge, from the time the base material is placed until the base is primed. When the shoulders are left high, water will get into the edge of the base course and soften it. Furthermore, if left high there is always a tendency to machine the shoulder material in with the base. It is suggested that the shoulders in the rough grading operations be held down level with the subgrade, and that the shoulders supporting the base course be constructed either by pushing out satisfactory material from the sub-base and subgrading for the base course or that suitable material be hauled in for the shoulders as the base course operations progress. Before the shoulders are finally dressed to the proper section, careful inspection should be made and any unsuitable material removed. Shoulder material must be of a pervious nature in order to provide drainage from the base.

Whenever the quality of the material used in the shoulders is inferior to that used in the construction of the base, the material used should have more than 55% of the total retained on the No. 200 sieve, or if less than 55% of the material is retained on the No. 200 sieve, the liquid limit shall not exceed 35.

The construction of the surface treatment should be considered only as an initial step in the proper conditioning of the highway in order that it will give good traffic service at the minimum cost.

The first item in the construction of the top is the prime coat. The prime acts as a dust layer and permits the hot application of bitumen to adhere better. Also the prime coat will materially help to shed the water from the road after rains and therefore speed construction. The prime should be placed only when the base is thoroughly compacted and moist enough to prevent ravelling. By using the proper viscosity of material that will slightly penetrate into the base, a good prime results.

The grade of prime used under average summer weather conditions is grade TC 3 for most sand-clay and gravel bases. Grade TC 4 is used where a very coarse sandy base is encountered. For "tight" gravel, chert or top-soil bound stone bases we use grade TC 2. As the weather gets cooler we lower the viscosity of the tar for each type of base by about 5 to 10 points.

The forming of the mat for the surface treatment is the important part of the work. In order to get a good mat, several details are of utmost importance.

The primed base must be dry and clean. Particles in the surface of the prime that would absorb the hot application should be scraped off. The temperature should be warm and not windy. The aggregate should be dry or the atmosphere such that it will dry the aggregate within one hour after it is spread on the road. The aggregate must be carefully placed so that it will completely cover the entire bituminous application, yet not leave any excess to be rolled around and ground up under traffic. The aggregate should be as near one size as practicable, reasonably clean of fine material and must be free from dust. The amount of bitumen used should be such that it will firmly hold the aggregate; make a waterproof membrane next to the base and not be excessive so as to cause bleeding in a few months. The bituminous material should be applied at a uniform rate and at an average temperature not so hot that it will burn the bitumen nor so cold that it will chill too quickly after applied on the road.

We use grade AC 10, which is 180 to 200 penetration asphalt for the hot application. If tar, we use grade TP 1, which has a consistency of 100 to 160 seconds in the float test at 122° F. As the weather gets cooler a softer material is used; up to about 300 penetration if asphalt, and for tar as soft as TH 1, having a consistency of 150 seconds in the float test at 89.6° F. The amount of bitumen used is 0.42 gallon per square yard, and each load is applied with a tolerance of not over 5%.

The aggregate is spread immediately following the application of the bitumen, and after lightly brooming same so as to get a uniform cover, it is rolled once and traffic is permitted on the road. We use aggregate meeting the following gradation requirements:

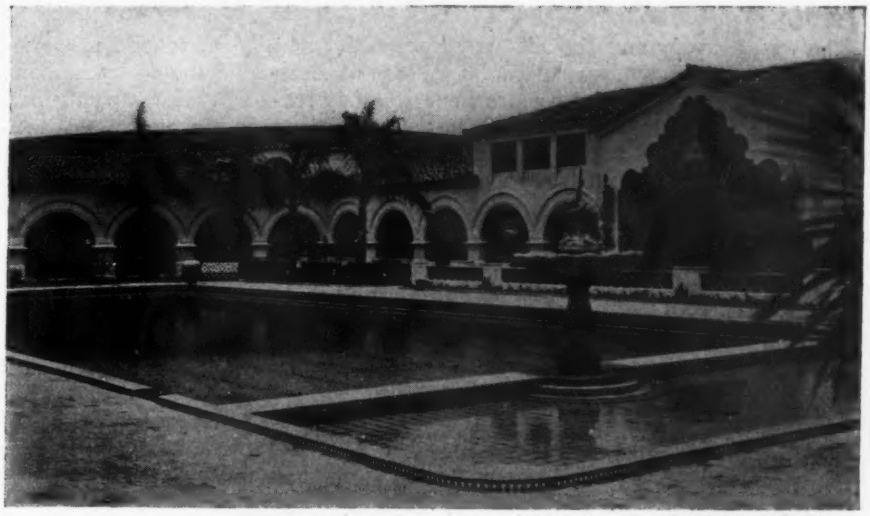
Total passing	*Percentage by weight*
1¼-inch sieve	100
1-inch sieve	95 to 100
¾-inch sieve	25 to 60
½-inch sieve	0 to 10
No. 4 sieve	0 to 2

We have used slag, stone and round gravel for this first application of the surface treatment.

Best results are obtained when the hot bitumen is covered with approximately ½ cubic foot of aggregate per square yard. It is sometimes necessary to use an additional 10% of material in order to get a uniform cover over the entire surface.

Traffic will imbed the aggregate into the bitumen and thereby make a mat. It is believed advisable to place a seal coat on the surface treatment. The seal coat may be one that partly fills the voids of the coarse aggregate or it may be one that completely covers the surface treatment so as to approach a water tight surface and at the same time provide a wearing surface of more strength, thickness and one that would resist the wear of vehicles longer.

Suggestions For Designing Swimming Pools



Courtesy the Permutit Co.

Pool at Agua Caliente. Excellent example of artistic setting for healthful enjoyment of clear, safe water

THE designing of a swimming pool is affected fundamentally by a number of factors, while many others influence the less important features of the design. Among the fundamentals are the number of persons to be accommodated and their ages, swimming ability, etc.; whether the pool is to be used for swimming contests, diving, etc.; whether it will be indoors or out; the climate; the source of water supply and its suitability untreated; the amount of money available; the regulations of the State Health or other department governing swimming pools. Secondary considerations have to do mostly with ornamentation, accessories and related structures—the materials used for lining the pool; the inlet, outlet and drain fittings; railing, ladders and steps; under-water and overhead lighting; dressing rooms and other features of the adjacent or enclosing structures.

Public pools and most private ones must provide for both swimmers and non-swimmers. It is generally taken that the water less than 5 ft. deep will be used by the latter, while a minimum of 3 ft. 6 in. is desirable for swimming, and at least 7 ft. for springboard diving and considerably more for tower diving. The shallow end slopes from 5 ft. depth to about 3 ft., or to a sandy beach for young children. There should be no steps or breaks in the bottom of the shallow end, but it is desirable to place some device between the non-swimming and deep swimming areas such as floats, a ridge about a foot high (Chicago South Park, Com'n.) etc.; or the two may be entirely separated by a wall or fence.

The relative areas allotted to swimmers and non-swimmers will vary greatly with the use to be made of the pool. For an athletic club, one pool at least may be devoted to swimming only. For a children's playground, the depth may have a maximum of 3 ft. or 3 ft. 6 in. For a general-use public pool, 50 to 80 per cent of the pool will generally be apportioned to non-swimmers; but for swimming and diving at least 40 ft straight away is necessary, either longitudinally or crosswise of the pool. For swimming contests, the length of swimming water should be exactly 100 yds. between walls, or a half or a third of this, with a width of 5 to 7 ft. for each racer; the walls being vertical, without scum gutter or other break and rising 18 in. above the water to provide a good take-off. However, it is desirable that no part of a pool be more than 25 ft. from an end or side wall, both for the safety of the swimmers and to facilitate cleaning of the pool and inspection of the bottom. This generally means that pools providing for swimming contests can not provide for non-swimmers.

In determining the depth, it should be remembered that the greater the average depth, the greater the cost of construction and the amount of water to be provided, purified and circulated.

The total area necessary for an assumed number of bathers is generally calculated on the basis of 10 sq. ft. of pool area for each non-swimmer and 27 ft. per swimmer and diver (diving board not to project more than 6 ft. beyond the edge of the pool), these being the figures recommended by a joint committee of the American Public Health Ass'n and State Sanitary Engineers. The rules of the A.P.H.A. also require at least 19 cu. ft. of water per bather for fill-and-draw pools.

Fig. 1

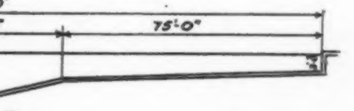


Fig. 2

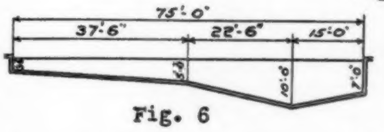


Fig. 3

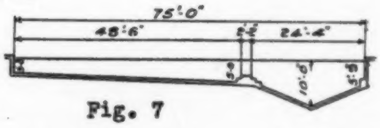


Fig. 4

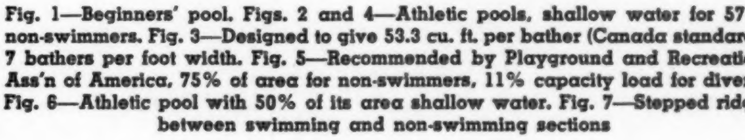


Fig. 5

Fig. 6

Fig. 7

Fig. 1—Beginners' pool. Figs. 2 and 4—Athletic pools, shallow water for 57% non-swimmers. Fig. 3—Designed to give 53.3 cu. ft. per bather (Canada standard), 7 bathers per foot width. Fig. 5—Recommended by Playground and Recreation Ass'n of America, 75% of area for non-swimmers, 11% capacity load for divers. Fig. 6—Athletic pool with 50% of its area shallow water. Fig. 7—Stepped ridge between swimming and non-swimming sections

The water supply must be adequate in quantity and also in quality. A common rule is 50 gallons of clean water per bather. In some case a stream or well may furnish this, but in the majority of cases this amount is not available and the used water is continuously withdrawn, rendered clean and returned, some make-up water being added to replace that splashed into the gutters or removed on the bathers—approximately 10% a day. The quality of the water is definitely regulated by the health departments of most states. An excellent typical regulation, that of California, is as follows:

Every swimming pool shall be provided with an adequate water supply including such water purification works as may be necessary so that (a) the water in the pool shall at all times of use be sufficiently bright and clear that the body of a bather or an object simulating it on the bottom of the pool in its deepest part will be plainly visible from the edge of the pool surrounding the deep end and (b) the bacterial condition of water in the pool and of water as admitted to the pool shall be such that at all times, including times of intense use of the pool, samples of water taken from any part of the pool will not contain more than 1,000 bacteria per cubic centimeter when plated on standard Agar medium for 24 hours at 37° C., nor B. Coli in more than one or two one cubic centimeter portions of water when confirmed on solid medium. Samples are to be collected, stored and analyzed according to latest Standard Methods of the American Public Health Association for the examination of water.

Whenever disinfection of the water by chlorine or chlorine compounds is depended on for bacterial safety, tests for the presence of free or excess chlorine shall be made at least twice daily by the operator, to insure the maintenance of free chlorine adequate for disinfection in all parts of the pool whenever it is in use.

Floating scum and sputum shall not be allowed to accumulate in the pool and means shall be provided for its constant, or at least its daily, removal.

Water added to any swimming pool or to any part of the swimming pool piping system, from a domestic or drinking water system, shall be added overhead with a free overfall in order to prevent, under all circumstances, backing up of swimming pool water or drainage into any drinking water system, as may occur under conditions of reduced pressure or vacuum conditions in the drinking water piping.

Unless water repurification is to be utilized, a swimming pool should have available and be able to use a supply of clean, clear water adequate to fill the pool over night, and be able to fill the pool at least twice a week; this in order to have a clear, sanitary body of water which will meet these Regulations.

If the available water supply is not apt to meet such specifications, for both quantity and quality, installation of a recirculation system with filtration, and works for disinfection of the water, are highly recommended to maintain the water in a clean, clear and bacterially safe condition. The construction of a swimming pool is inadvisable where the available water supply is limited or costly or if it is not thoroughly clear and clean, unless the system includes water repurification works.

For the removal of floating scum, the construction of a narrow, deep scum gutter, placed in the sidewall all around the pool, is highly recommended. This gutter also serves as a hand rail. The gutter should not be built in the top of the wall because then it is apt to become a dirty, open drainway. In the case of an existing gutter in the top of the wall, special precautions shall be taken to keep it clean and sanitary.

Where the water supply is sufficiently pure and abundant, it may be allowed to flow through the pool continuously. If the quantity is inadequate for this, it may be used on the fill and draw principle, being used until the load of impurity reaches the sanitary limit, when it is emptied and the pool cleaned and refilled with clean water.

In the recirculation system, the water is continuously withdrawn by a pump, passed through purification equipment and returned to the pool; in some plants being heated also. This requires installing pump, and clarifying and sterilizing equipment; the former to remove hair, lint and other suspended matters, the latter to destroy bacteria contributed by bathers.

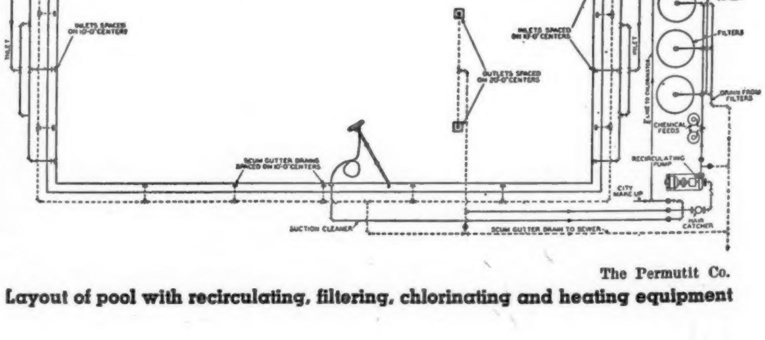
The capacity of pump and filter will depend upon the number of turnovers of the pool water a day. For pools used by only a few people, once a day may be sufficient. For public pools with heavy bathing loads, three or even four times a day may be necessary. It has been calculated that a 4-a-day rate operating only fourteen or fifteen hours a day will maintain as good sanitary conditions as a 3-a-day operating full time and will require handling only about 80% as much water. The recirculation should not be confined to the hours of bathing, for so long as dirt is being added to the pool the dirt density will increase until the pool becomes loaded to a point where each volume that is drawn off in a given time contains as much dirt as that added during the same time. Thus the recirculation which is really effective in cleaning the water is that which takes place when the pool is not in use; that while it is in use merely keeps the dirt density from becoming too high. Of course, the recirculating plant can be made large enough to change the supply so frequently that the dirt density will not exceed any assumed limit; but the cost of installing and operating such a plant say 12 hours a day might easily be more than 16 hours' operation of a smaller 4-a-day plant. In some cases the plant is operated at a 4-a-day rate during bathing periods, and at a 2-a-day rate during non-bathing or lightly used periods, two units (with desirably a third in reserve) being provided to permit of this.

With the greater concentration of bathers and shallower water at the non-swimming end of the tank, the dirt concentration is apt to be four or five times as rapid here as in the swimming end, and arrangement of inlets and outlets so as to displace the water here more rapidly than in the deeper end is desirable; or else having most of the fresh water enter at this end and be withdrawn at the other.

Filtration does not remove soluble salts from the bathers' bodies and these tend to accumulate in the water; but so slowly that the make-up water will generally prevent serious accumulation.

Reference has been made to heating the water. It has recently been found in England that heating the water, even in an outdoor pool, to approximately the temperature of the air above it proved so attractive as to double the attendance, while the cost was not great. There was no loss of heat to the atmosphere during the day, or no greater than was made up by the body heat of the bathers; so that, once the pool water had been warmed in the morning, after the night's cooling, only the make-up water needed warming. Higher than air temperature is undesirable for several reasons.

(To be continued)



The Permutit Co.

Layout of pool with recirculating, filtering, chlorinating and heating equipment

A 1½-Inch Tar Surface on a Clay-Calcium-Chloride Stabilized Base

By JULIUS F. HUBER
Washtenaw County, Michigan, Maintenance Superintendent

DURING the summer of 1934 a 5½-mile section of the North Territorial road in Washtenaw County, Michigan, was stabilized with a sand and clay-calcium chloride treatment with the idea to later place a bituminous-bound surface upon this base.

This road is a main county trunk line running generally east and west through the upper section of Washtenaw County and joins on the east with a pavement in the adjoining county of Wayne and approximately 13 miles from the west city limit of Detroit. The countryside bordering this road is generously supplied with lakes which attract the residents of Wayne County. The volume of passenger car traffic therefore is excessive for a loose gravel road, especially during the summer months, and from the standpoint of maintenance costs and the problem of how to eliminate the serious dust nuisance it was imperative that the road surface be improved.

The existing loose material was bladed into a windrow in the center of the grade, to which was added a sufficient quantity of new gravel to make a finished mat 3 inches thick by 21 feet wide. A careful control of gravel quantities is had by means of a measuring box of commercial manufacture into which the gravel is dumped from trucks and hauled by the same trucks along the center of the road.

This material was tested for gradation in order to calculate the amount of clay necessary to obtain a mix previously determined. In this case approximately 160 cu. yds. of clay per mile were used, which resulted in a final mix with a P. I. of between 10 and 12.

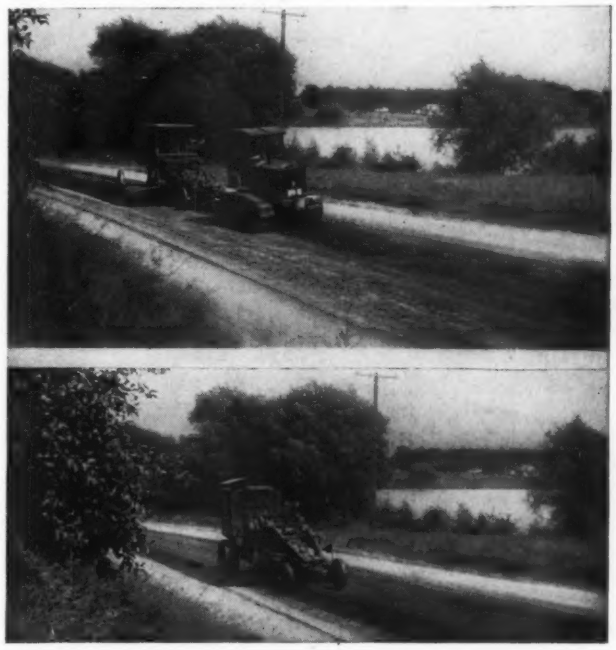
This larger windrow in the center of the road was then divided evenly into two windrows and placed on each side of the grade. A clay deposit was fortunately located practically at roadside and was loaded into county trucks by a gasoline shovel. Although in a rather lumpy condition, careful measuring was possible as later tests proved. This clay was dumped directly on the road surface between the windrows of gravel, spread evenly, allowed to dry and was pulverized with a disc harrow and roller. The gravel windrows were then bladed to the center of the grade and mixed with the clay by blading it from one side of the road to the other with two power graders and one crawler type tractor and 10-foot pull-type grader. This required from ten to fifteen operations.

Following the mixing operations, the material was again divided into two windrows and placed on the roadside from where it was bladed across the grade in layers approximately ½ inch in thickness. Enough water was added between layers to properly compact the material which was finished to proper grade and contour and finally rolled.

After the rolling, another light sprinkling of water was applied, following which, flake calcium chloride was spread six to seven tons per mile.

Very little maintenance was necessary the balance of the summer except an occasional blading following a rain and light applications of calcium chloride to retain moisture and surface fines.

The above light maintenance was continued until August, 1935, when a treatment of tar was applied 1½ inches deep by 20 feet wide.



Above—One of the units used in mixing tar and aggregate. Below—Power grader with experienced operator laying out the surface for rolling

There was no loose material on the surface and therefore only enough gravel was added to result in the above mat, the quantity being approximately 500 cu. yds. per mile. This aggregate was a bank run gravel, screened and the oversize stone crushed, all of it passing a wire mesh screen with 1 inch square openings.

A measuring box, the same as used for surface stabilization, properly proportioned the new gravel.

The tar used was a light retread material of a 25-30 specific viscosity at 122° F., which was applied at the rate of ¼ gallon per sq. yd. per application. Between applications the materials were mixed with power blade graders, this operation of mixing and applying tar continuing until the correct quantity of 1¼ gallons per square yard had been added and the mass thoroughly mixed. This being accomplished, the material was bladed to one side of the road and the surface swept. A header 1½ inches deep at the outside and running to zero at a point 18 inches from the outside edge, was cut by a power grader. This half of the base, including header, was primed with the same tar used in the mix. The mixed material was bladed onto the primed surface and the same operation performed on the other half of the road. The material was then spread over the full width to proper grade and rolled.

The advantage of the header is the increased thickness of metal at the edges where most failures occur.

To date a negligible amount of surface maintenance has been necessary, due, the writer believes, to the stable base upon which the treatment was placed and which gives it the needed strength to withstand the impact of heavy vehicles.

The Present Status of Textile Waste Treatment

TREATMENT of industrial wastes is a problem for the sanitary engineer in the solving of which he should receive the cooperation of the industries; and on the other hand, he should be able to aid the industries with technical advice for such solution. This applies especially to engineers of State health boards.

The past ten years or so has seen notable development of this wish to cooperate, especially on the part of the industries. Most of the more important ones are coming to recognize their responsibility for ameliorating the stream pollution conditions and sewage treatment plant difficulties which their wastes create. Larger volumes of waste are produced by the textile industries than by any other one trade, and the Textile Foundation (organized "for scientific and economic research for the benefit and development of the textile industry, its allied branches, and including that of production of raw materials") has for several years been cooperating with the University of North Carolina in a study of textile waste purification. It granted a junior fellowship at that university in 1932-1935, and in 1935 a Survey of Textile Waste Treatment was initiated to secure more data and information. The survey was made by John C. Geyer and William A. Perry, in cooperation with the University of North Carolina and with an advisory committee consisting of professors C. R. Hoover, Willem Rudolfs, T. R. Camp, A. H. Grimshaw, A. M. White and F. K. Cameron, H. W. Streeter and Hill Hunter, with Dr. H. G. Baity as general adviser. The result of the survey has been published in a report of 118 pages by the Textile Foundation, Commerce Building, Washington, D. C. Some of the more general and inclusive paragraphs are quoted or abstracted below. The report includes descriptions of the many types of textile wastes and of several plants constructed to treat them.

The report consists of two major parts—a non-technical discussion of all phases of the problem, and a detailed presentation of technical information. The important points presented in the first part are summarized by the authors as follows:

1. The treatment of textile wastes becomes necessary when the purity of a stream is damaged to the extent that a nuisance is created or serious economic losses are incurred by users of the stream for purposes other than waste disposal.
2. Different standards of purity should be selected for various streams depending upon the purposes for which they are used, and the textile wastes discharged should then be purified sufficiently to maintain these stream standards.
3. There are not many possibilities for realizing a profit from the recovery of by-products, but frequently when waste treatment is required, recovery or re-use offers a means of reducing the overall expense of disposal. The volume of waste to be purified may be materially reduced by the use of modern equipment and the careful control of operations within the mill.
4. Although many textile waste treatment plants have been built which operate satisfactorily, there are wide differences of opinion as to which methods are most satisfactory for treating the various textile wastes.
5. Since wastes from different mills differ in character, some experimentation at each mill is required in order to select the proper treatment.
6. Chemical precipitation methods have been found to provide satisfactory and usually sufficient treatment for wastes which are not exceptionally high in organic content, *e.g.*, wastes from dyeing and finishing operations; while chemical precipitation followed by mechanical filtration or biological purification is generally required for the wastes containing large amounts of organic matter, *e.g.*, wastes from deterging operations. Soaps, oils and waxes in a waste interfere with chemical precipitation. Certain dye wastes which do not respond to chemical precipitation must be purified by bleaching or by using an absorptive material to remove the color. The cost of treating a waste by chemical precipitation generally lies between 10 and 20 cents per 1,000 gallons. The satisfactory operation of any treatment plant depends on scientific and conscientious control.
7. Where possible, the best method of disposing of textile wastes is to discharge them into the domestic sewers. Some preliminary treatment of textile wastes will frequently be required. When the municipal sewage is treated biologically, sulphur dye wastes and certain other wastes should never be discharged into the domestic sewers without preliminary purification. The presence of textile wastes in domestic sewage materially increases the expense of operating a municipal disposal plant. This additional expense should be properly apportioned among the manufacturers.
8. Past research has related almost entirely to the solution of local problems. This past work has been, for the most part, the trial and error type of experimentation. Fundamental research is needed to determine the colloidal and electrical nature of the substances carried in textile wastes and to work out methods for removing the various types of polluting matter.
9. Coordination of research and dissemination of information by an organization supported by the textile industry is desirable.

Each textile waste disposal problem involves so many complicating factors that its solution must not be undertaken hurriedly. The requirements in each case must provide for justice and must be founded on sound principles of economic conservation. A thorough study of the technical phases of each problem is necessary. The solution of these complex problems can be attained only by continuous endeavor and by sympathetic cooperation on the part of both the manufacturer and the authority.

State Laws Governing Stream Pollution

The State laws governing stream pollution by industrial wastes are analyzed in an appendix, from which it appears that Georgia, Idaho, Nevada and Virginia have no such laws; Mississippi none except authority invested in the State Board of Health to regulate conditions; Missouri's laws have proved unenforceable, and South Dakota's unconstitutional. Certain streams are exempted by Delaware, Illinois, Iowa, Maine, Michigan and New Hampshire. Penalty for violation is provided by all except the District of Columbia, Michigan, Mississippi, Missouri, New Jersey, North Dakota, Tennessee, Utah, Washington and West Virginia. Approval of disposal plans is required by Colorado, District of Columbia, Florida (under certain conditions), Georgia, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, South Dakota and Wisconsin.

Cooperation with industry in solving the problem is furnished by all the states except Alabama, Arizona, Colorado, Delaware, Idaho, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, Oregon and Vermont; this including laboratory assistance in Connecticut, Florida, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Jersey, New York, North Carolina, Oklahoma, Tennessee, Texas, Virginia, Washington, West Virginia and Wisconsin.

Jurisdiction over pollution control is in the hands of the State Board (Department or Bureau) of Health in all the States except California (Dept. of Natural Resources), Illinois (Sanitary Water Board), Michigan (Stream Control Commission), Pennsylvania (Sanitary Water Board), Rhode Island (Board of Purification of Waters), and West Virginia (Water Commission)

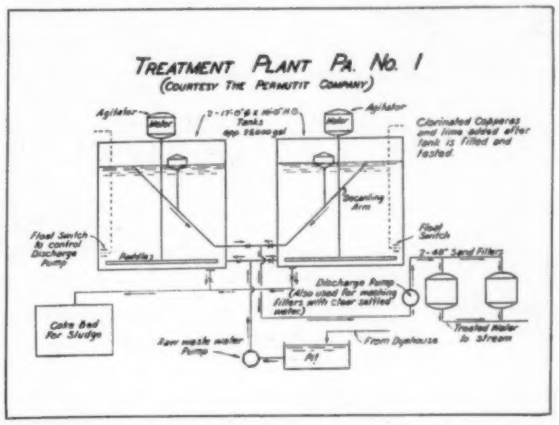
Jurisdiction is shared with the Water Commission in Connecticut; the Fresh Water Fish Commission in Florida; the Depts. of Public Safety and of Conservation in Massachusetts; the Game and Fish Dept. in Missouri, Montana, New Mexico, Oregon, and Texas; the Public Utilities Commission in Maine; Passaic Valley Sewerage Commission in New Jersey; the Stream Sanitation Commission in North Carolina; Dept. of Agriculture in Tennessee; and with the Dept. of Conservation in Alabama, Indiana, Louisiana, Maryland and New York.

Plants for treating textile wastes are discussed under two heads—those treating the wastes alone, and municipal plants treating them as part of the sewage. Under the former head ten plants are described, two of which are in England; and under the latter head, three English and three United States plants. These, of course, are a very small percentage of the total number of plants treating textile wastes, but are presumably presented as being typical.

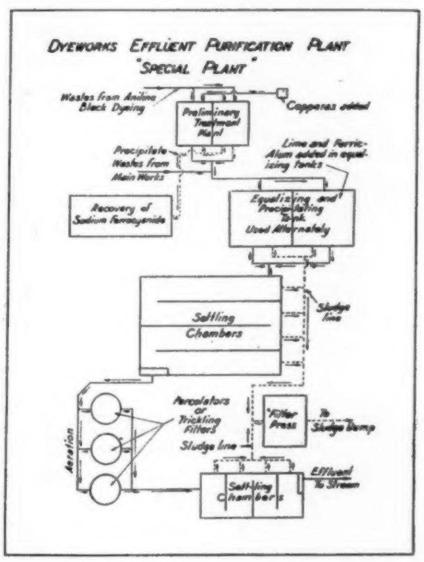
"A number of good plants have been designed. These plants cannot be adapted to treatment of other mill effluents without consideration of local conditions. Each waste presents a special problem in purification that requires thorough investigation before the most economical treatment unit can be designed. The successful operation of a properly designed plant will depend to a great extent on careful and constant supervision.

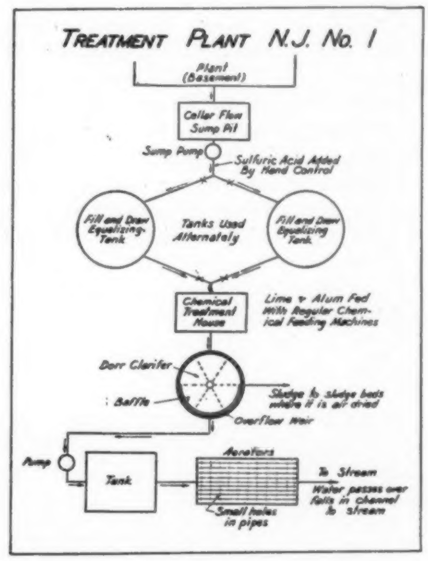
"Much can be learned, however, from a thorough study of the methods that have been applied. The means adopted for the treatment of textile waste liquor vary greatly in the methods of adding precipitants, the kind of settling tanks employed, the filters used, and other appliances."

In treating wool scouring liquors, the most important



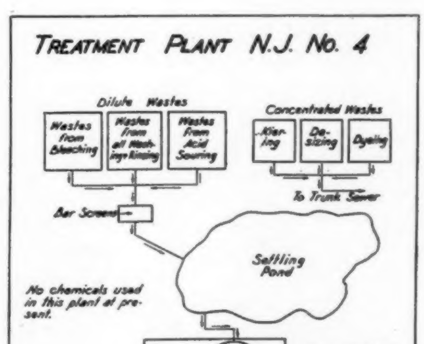
Treating waste from silk degumming, and dyeing and finishing of silk, cotton, rayon and wool hosiery; about 10% from degumming. Coke from coke bed is burned.

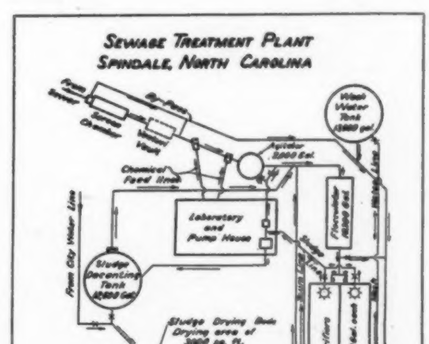




Upper left diagram—This plant treats waste liquors from bleaching, mercerizing, cotton and rayon dyeing, aniline black dyeing by the prussiate method, and finishing of the dyed fabrics. Sodium ferrocyanide is recovered from the aniline black dye waste liquor. "This is no doubt one of the best purification plants in operation."

Upper right—Treats waste from mercerizing, bleaching, dyeing, washing and rinsing cotton materials—50,000 gal. in 10 hrs. About 15% mercerizing wash water, 25% spent dye and dye wash water, rest from bleaching and kiering. "One of the most successful treatment plants in operation."





Lower left—Treats 1,500,000 gpd from processing 400,000 cards of cloth. All dye, desize and kier liquors are pumped direct to the Passaic Valley sewer. Bleach, sour wash and rinse wastes are run through the treatment plant. No chemical treatment. "Good example of the separation of wastes and combining those of opposite nature to effect co-precipitation."

Lower right—Municipal plant for max. flow of 600,000 gpd, ¼ domestic, ¾ wastes mostly from hosiery mills. Chemicals to be selected by experimentation at plant. Textile wastes first collected in 1.5 mg basin and fed to sewer at uniform rate. "One of the first complete layouts of water purification type that has been designed to treat textile wastes."

recovery methods employed are the acid method (little used now because it requires considerable space, the grease recovered is of an inferior grade, and the seak tank effluent is expensive to purify); evaporation or Smith-Leach process (expensive and not used extensively since the world war); the centrifugal process, developed by the Sharpless Co.; and the Duhamel, a French development, which recovers high-grade grease efficiently and produces only a relatively small amount of liquor requiring purification.

The processes employed at the typical plants are described in detail in the report, but space does not permit giving the description here. Considerable can be learned from the plans which are given, a few of which are reproduced (considerably reduced in size) from the report.

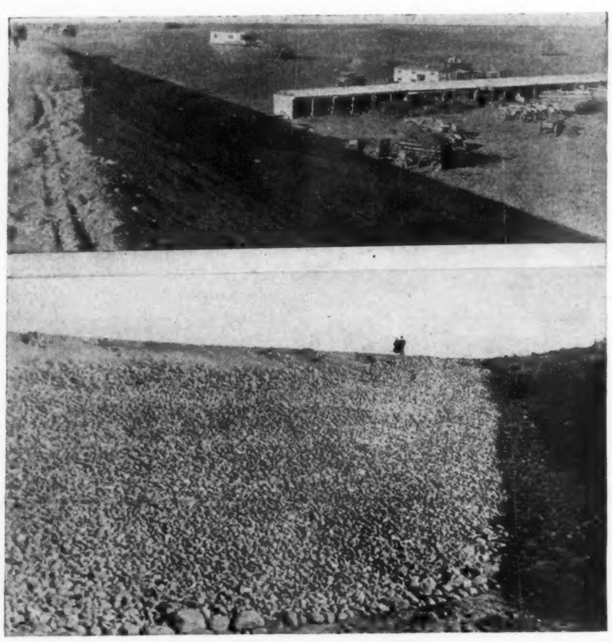
Faulk County Builds Fifteen Dams for Water Conservation

By R. H. BURRILL
Highway Superintendent, Faulk County, South Dakota

FAULK County, S. D., upon the organization of the W.P.A., immediately instituted a program for the construction of a number of earth dams for water conservation purposes. Up to September, 1936, fifteen such dams have been built, the largest impounding 106 flood acres and the smallest 40 acres.

The largest lake was the first one to be constructed. Being located only a short distance from Faulkton, the county seat, it inspired a great deal of interest and enthusiasm among the people of that community. It has since been developed into a beautiful lake, with a public bathing beach and a number of summer cottages have been constructed.

This lake required a dam 40 feet high; the freeboard is 8 feet; approximately 40,000 cubic yards of dirt was required for construction. Preliminary surveys showed underlying gravel to a depth of 22 feet. This required trenching, and a clay core was carried down to an impervious stratum. The upstream face of the dam, which has a slope of 1:3, was rip-rapped with 1,970 cubic yards of field boulders which were placed by hand. The spillway is of concrete, 100 feet in length.



Top—Back of dam, showing shelter for horses and portion of equipment used. Bottom—Field boulders hand-placed on a three-to-one slope.

Labor and a large percentage of materials were paid for by the W.P.A., the county furnishing the remainder and also all of the equipment for construction. This included Caterpillar tractors, a "60" elevating grader, trucks, and several 1¼-yard horse-drawn dump wagons. The project, which was under the direct supervision of the Highway Superintendent, furnished employment for 60 men over a period of 5 months.

The construction of these dams throughout Faulk County has been both popular and successful, while providing a means of utilizing the W.P.A. labor most advantageously. Needless to say, the water from these lakes has been of great benefit. The larger lakes have been stocked with fish by the State Game and Fish Commission.

Sealing Refuse Dumps by Plastering

So-called sanitary dumps containing organic refuse are generally made by spreading the refuse in layers and at once covering them with soil to a depth of 6 to 12 inches, this including the face as well as top of the dump. The purpose is to prevent direct access to the organic matter by insects, rats and other vermin, to prevent fly breeding, to promote anaerobiosis and for appearance sake.

Given plenty of earth or ashes available at low cost, this method of covering is probably as good as any. But where earth is expensive to obtain at the site of the dump, other methods may be better. In Shanghai, China, D. H. Harbottle, of the Public Works Department, has had success with plastering the dumps with a mixture of 2 parts of mud and 1 part of cotton mill sweepings. There the refuse contains the eggs and larvae of flies when it reaches the dump and further infestation takes place before it can be covered. The plaster covering prevents the emergence of flies or larvae and the escape of heat, which reaches 115° to 150° at a depth of 2 feet.

In applying the cover, the top and face of the dump are leveled off and a 3-inch layer of earth and ashes applied. On this, the mud and cotton plaster, wet to the consistency of mortar, is spread 1 inch thick. This cracks on drying, and a second thin coat of the plaster is applied with a trowel. This is watched for a period of 30 days and any further cracks are plastered. Three or four days' refuse (3,000 to 5,000 tons) was covered at a time by four men in one day, and the second coat on the second day. While the plaster is soft, larvae work their way through it and roll down the face into a trench along the toe of the dump which is kept full of water, in which they drown.

The Editor's Page

Winter Engineering, Operation and Maintenance Problems

Elsewhere in this issue are seasonable articles emphasizing cold weather engineering, maintenance and operation. For the most part, these problems do not exist for the most southern areas, for which the technical and administrative officials of the south should be extremely thankful.

The highway engineer will be interested in an article on the use of an alundum aggregate for improving traction on streets at danger points. Repairs to highway surfaces, to prepare them for the coming wear and tear of winter, should be made before freezing weather comes. Ditches and culverts should, of course, be cleaned and opened. As to snow removal, in both this and the preceding issues much of the latest equipment has been illustrated and described. It is probably too late in the north for roadside planting for drift prevention.

Icy streets should not be so much of a problem for the street superintendent as formerly. Methods of ice control by sand or cinders and chemicals are well known, and are not costly. A little planning and preparation will go a long way in keeping the situation pretty well in hand. Collecting garbage, which too often is frozen into the containers, and disposing of it is another of the problems of winter engineering; in regard to it, we refrain from giving advice.

The waterworks engineer and superintendent, likewise, should put his system in condition for cold weather. He cannot put antifreeze in his mains and rest in peace through the winter (the consumers probably would if he did), but ought to check over his hydrants to see that they drain properly and arrange for equipment for thawing frozen mains. (There have been many new developments in this field of late.) An article on another page will remind him of the vital necessity of chlorinating his water supply faithfully throughout the winter months, and will give him some practical information on how to keep his equipment operating with a minimum of trouble.

Sewage flows, rain or shine, hot or cold; perhaps once in a while the engineer or sewage plant operator wishes the system would freeze solid, so that he could take a day off. But even with sewage plants there are winter problems. As in the case of water, dependability of operation of the chlorinator is a prime requisite. Sprinkling filters must be put into good condition, the clogged portions of the bed, if any, being cleaned; to save future trouble, distribution mains in the filter should be checked to see that they drain properly; with the rotary distributor, some protection may be needed for the post. The heating apparatus of the sludge digestion tanks should be in prime condition in order to maintain proper digestion during the cold months; perhaps a little activated carbon in them will aid in digestion. The sludge beds—well you can't do much for them in really bad weather; either pray for "easy" winter or persuade your community to rush the construction of sludge bed covers.

The editors of PUBLIC WORKS try to keep in touch with good practice and with new development in the public works field. If they can be of service in solving any of these problems, we hope that the readers of this page will not hesitate to call on them.

Plumbing Control and Water Depts.

The advisability of the regulating of water piping and fixtures within buildings by the Water Department was a subject discussed at the recent convention of the New England Water Works Association, and one concerning which there were diverse opinions. Some entertained the idea that what the owner did on his own property was none of the department's business; others, that it was the city's duty to protect him against his own ignorance or carelessness. While from the viewpoint of the department's interest, the majority, probably, felt that they would avoid future trouble and the creation of hard feelings on the part of the consumers if they insisted on the use of the most suitable materials and workmanship; although several said they had no power to do so under their local ordinances.

Concerning the advisability, it seems to us that it is decidedly the duty of the department as a public servant to do all it can to see that the consumers and property owners do not lay up trouble for themselves by putting in undesirable plumbing. If it has not power to enforce this, it should do its best to bring to their attention information and advice on the subject. This can be done by articles in the local papers, by folders which the plumbers are asked to give to all who employ them, by personal interviews with architects, etc. (This presupposes that the department first informs itself fully on what *is* the best for its local conditions, character of water, climate, etc.)

One class of consumer deserves especial consideration—those who purchase built-for-sale houses, the builders of which are not concerned with the future troubles of the purchasers, whose ignorance of such matters can easily be imposed upon by use of cheap plumbing. Here the interest of real estate agents should be enlisted; it certainly is not to their interest to help sell houses which will make dissatisfied customers. This implies that the department inform itself of what kind of plumbing goes into all houses, even if it has no control over it, and warn the builder if it disapproves of same.

As to the power to control plumbing, it seems probable that in every municipality such power rests in some branch of the government; generally, perhaps, in a building department or inspector. The municipal ordinances generally require builders to comply with certain regulations intended to secure buildings which will be amply strong and durable, and in some cases reasonably fire-resistant. If these ordinances do not cover the plumbing also, control over this may rest with the health department. If no department has such control, the water department might well present the matter forcibly to the council. Whatever municipal official has such control, it should not be difficult for the water department (with a little diplomacy, if necessary) to secure his interest in cooperating to protect the taxpayers and consumers against unfortunate results of their excusable ignorance of such matters.

Practical Kinks for the Engineer

Contributions to this page are invited. Send in your kinks. Public Works will pay $3 each for those published.

Excellent Gasket Material in an Emergency

By F. W. Bentley, Jr.

When connecting up a portable pump and the necessary piping on an emergency highway job, some flange gaskets were found to have been lost or misplaced. The tool car was out of the sheet rubber of which such gaskets could have been cut. However, several pieces of old linoleum were procured from a nearby farm house and some very good emergency gaskets made for the flanges. It cuts easily and cleanly. Gaskets of it for water can be drawn up readily and will not leak a drop. A handy one to remember for this occasion which not infrequently occurs.

An Easy and Convenient Grip for the Scythe Stone

By F. W. Bentley, Jr.

The life of the common scythe stone is a long one indeed if it is lucky enough to last in one piece during the summer and fall seasons of weed cutting where the scythe must be made use of. It so easily slips from the hand when using, and it is all so easy to get the fingers close—too close to the blade. Take an old piece of tire inner tubing about 4" wide and some 6" or 8" long. Fold back about ¾" on one end and wrap the whole piece snugly around one end of the stone. Tie the raised portion on with a stout cord. Cut away the back or longer portion until but one or two turns are around the stone. Tie this snugly on also. There you are! A much better grip; moisture and grease from the hand cannot glaze the stone. A raised ferrule of rubber in this manner protects the hand when close to the blade and the soft rubber attachment keeps the stone from so readily slipping from the pocket which it often does with fatal results to the stone. A good stone of this kind is worth money. It can be neatly safeguarded in this manner.

Handy for Smoothing and Straightening Lagging Bands

Pipe lagging bands, which used in many places about the plant, are inexpensive, but one is often confronted with the necessity of reusing a considerable number which may be in a fair and unrusted condition. Smoothing them up neatly for reapplication is a job done of course in a number of ways with various things about the bench, some of them practical but unhandy. A simple device which works very well and handily for this purpose can be made from an old automobile brass windshield adjuster link, as shown above. The link is bent a trifle to afford a good grip with the hand. The bands, when drawn through the link, meanwhile being pressed on any convenient surface at the same time, come out restored to a smooth, even and unwrinkled condition. The bands are not scratched or marred by the brass of the link. After one or two trials the bands can be laid out on the bench as smooth and straight as they come from the factory. Nothing to make; and can be used almost anywhere.

Tope, smoothing and straightening lagging bands; lower, a scythe-stone wound with a piece of inner tube to give a good grip and protect the thumb and fingers.

You can make a passably good gasket out of old linoleum, if you have to.

Red Coats for Rodmen

At this season of the year, when all leaves are out, it is difficult to spot rodmen quickly in wooded or brushy areas. By equipping the rodmen with lightweight coats of bright red, visibility is greatly improved, on both short and long sights. These are especially valuable in topographical work where the number of "shots" is an important factor in the day's work.

Drainage for Mosquito Eradication

DRAINAGE has been and undoubtedly will continue to be an important weapon against mosquitoes, including the *Anopheline* or malaria carrier. The material in this article is abstracted from a text prepared especially for the use of engineers on W. P. A. malaria control projects by Nelson H. Rector, assistant state director of malaria control of Mississippi. This and other material on the same subject have been issued as a report of the National Malaria Committee by the U. S. Public Health Service.

Mosquito control drainage differs from other types of drainage in that it is designed to remove all residual water remaining for a period as long as 7 days, which is the approximate minimum period of time required for hatching of Anopheline mosquitoes.

The first step in any control compaign is the reconnaissance, which should cover the following factors: (1) Location of breeding areas; (2) character of breeding areas; (3) selection of ditch location; (4) notes of type of soil (5) outlet for ditch; (6) possibility of obtaining property damage releases.

Those mosquito-producing areas that are in proximity to centers of population should be given first preference, and subsequently all producing areas within 1 mile (the approximate flight range of the mosquito) should be drained. In making the reconnaissance, the investigator should note the presence of mosquito larvae, the types, favorable or unfavorable conditions for production, and whether pools of water are permanent or temporary.

The producing areas having been located, the engineer next selects a possible center line for the ditch. In general, this should follow natural depressions, but should avoid sand beds, rock formations and other difficult trenching areas. Trenches are easy to dig in sand, but the flat side slopes required involves removing much material, and after-maintenance is difficult.

Ditch Size and Section

Ditches with narrow bottoms are usually employed in malaria control work, as these do not fill so rapidly as flat, wide-bottom ones; also the flow of water is more rapid, and there is less chance that potholes will form in the bottom, providing breeding places for mosquitoes.

The section must be large enough to prevent the ditch from overflowing and to prevent undue erosion from high velocities. Allowance should also be made for weathering of the side slopes, as in average soils some loose material slides into the ditch and reduces the bottom width.

Where feasible the ditch should be constructed as shown in Fig. 1. The dimensions shown are those recommended for a ditch having a bottom width of 2 feet. After the ditch has been dug to the correct grade, the finishing crew constructs the curved bottom, ACB.

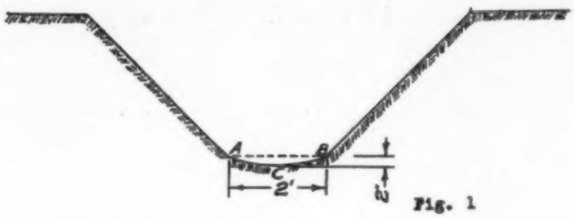


Fig. 1

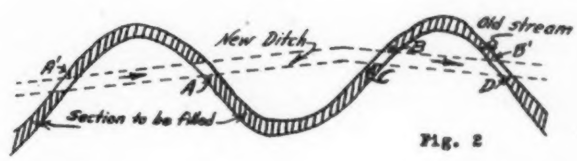


Fig. 2

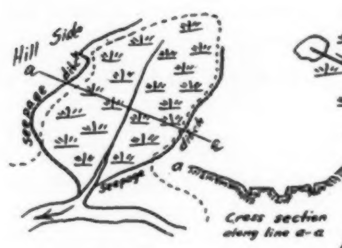


Fig. 3

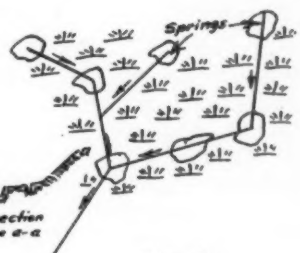


Fig. 5

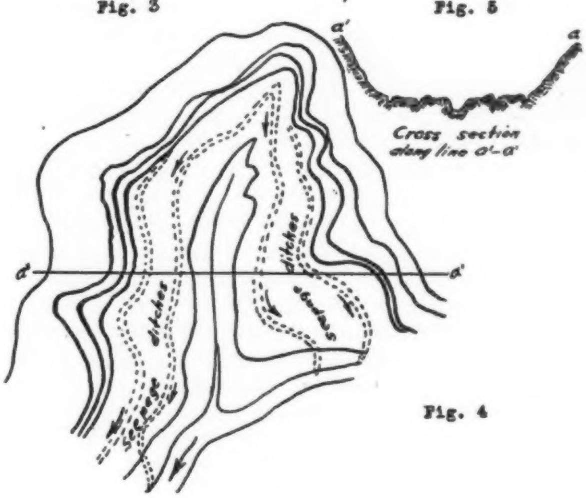


Fig. 4

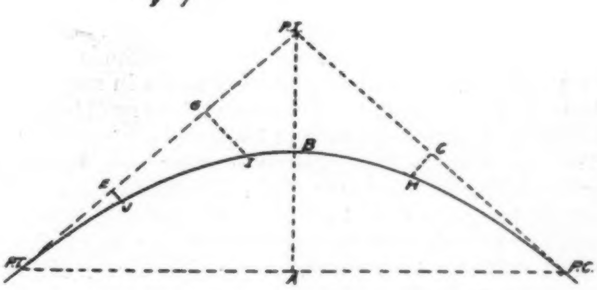


Fig. 6

The center of the curve will be 1 inch lower than the grade of the ditch for a ditch with a 1-ft. bottom width, 2 inches lower for a 2 ft. bottom width, and in proportion for larger ditches.

The bottom of the ditch should be at least six inches below the lowest point in the pond or swamp to be drained. If it is impossible to drain a pond completely, the small area remaining should be stocked with *Gambusia affinis*, or top-feeding minnows. It may also be necessary to dig a well in the center of this area to keep the minnows alive in dry weather.

Hand-dug ditches are seldom satisfactory if over ten feet deep. The side slope of the ditch under average

conditions should be 1 on 1, but will vary with the type of soil, from vertical in rock to a ½ on 1 in stiff clay, and to as much as 2 on 1 in loose sand and in fine sand with silt.

The minimum grade of an open ditch is 0.05 foot per 100 feet and the maximum should not be more than 1.50 feet per 100 feet, except in soil that will not erode. Long straight grades are preferable to short choppy ones. When the change is abrupt, a vertical curve is put in.

The excavated dirt on small ditches should be scattered evenly on each side. If the ditch is subject to overflow, the dirt must be scattered or, in the case of large ditches, placed on the lower side. If it is impracticable to eliminate spoil banks, as is the case on large ditches, frequent openings should be dug through them and a berm of at least three feet left on either side.

Special Problems

Where a cut-off is dug across bends in an old stream, the excavated dirt can always be utilized to advantage to fill the old run or stream bed, see Fig. 2. The sections of the old run lying between A and C and B and D should be filled with dirt excavated from the new ditch. The filling operation should begin at A and B respectively and proceed downstream. It will be necessary only to fill the potholes in the bed of the old stream to an elevation higher than that of the grade of the new ditch. Dams consisting of logs, stumps, rip-rap or any other available material, may be constructed at points A', A, B and D, in order to force the stream through the new cut-off.

In draining seepage areas, it will be necessary to construct narrow deep ditches along the toe of slope of the hill, as shown in Fig. 3. In some instances, it will be advisable to construct a series of parallel seepage ditches rather than one deep ditch (see Fig. 4). These ditches should be only a spade wide at the bottom, but deep enough to intercept the seepage outcrop. No rule can be laid down as to the correct depth. An earth augur should be utilized to determine the height of the water table. This information will be indispensable in locating the center line of the seepage ditch and in setting the correct grade. If the seepage area is fed by a series of springs, it will be necessary to construct separate laterals to each spring (see Fig. 5). Cases will occur where a combination of these methods must be employed. Small open-jointed tile laid in seepage ditches makes the drainage permanent. The spoil banks on seepage ditches must always be placed on the lower side of the ditch to prevent surface water washing the excavated dirt back into the ditch. Another reason for placing the entire spoil bank on the lower side is due to the fact that these ditches are always dug in marshy ground and any load on the upper side of the ditch may tend to make it cave.

Main ditches in canals should be constructed first and, when possible, some time should be allowed to elapse before constructing laterals. Often it will be found that laterals which originally seemed necessary are not needed. Lateral ditches in most cases need be only a spade wide at the bottom. Laterals and branches should enter main ditches at as sharp an angle as possible, and should have a steeper grade near the outlet.

If a transit is not available for staking out curves, a parabolic curve can be located, as shown in Fig. 6, as follows:

The point marked P.I. is the intersection of the center line tangents. The P.C. and P.T. are located by measuring equal distances along the tangents from the P.I. Judgment will have to be used in selecting the proper distance from the P.C. to the P.I. Stake A is set halfway between the P.C. and the P.T. on a line connecting them. Point B (the midpoint of the parabolic curve) is halfway between point A and P.I. All offsets from the tangents to points on the parabolic curve vary directly as the square of the distance from the P.C. or P.T. For instance, point C is midway between P.C. and P.I. The distance CH is then one-fourth of the distance from the P.I. to B. Points E and G divide the distance from the P.I. to the P.T. into three equal parts; hence, distances EJ and GI are one-ninth and four-ninths, respectively, of the distance from P.I. to B.

Construction

Prior to construction, it is absolutely essential that all property owners sign damage release forms for all property across which the proposed ditch will pass. Threatened lawsuits have resulted from failure to secure a release in instances where the ditch cut only a few feet off the corner of a lot and caused no real damage.

On large projects, it is well to divide the crew into four separate groups and assign them to the following work: (1) clearing, (2) grubbing stumps and roots, (3) roughing out the section, and (4) finishing the ditch. Each gang will do the same work continuously and, as a result, will become proficient. The most accurate and painstaking men should be assigned to the finishing crew.

Construction work should begin at the outlet and proceed upstream. The center line is staked, and one-half the bottom width is laid off on each side of the center line. Strings are then stretched on the stakes marking the bottom width of the ditch and the sides marked off with a square pointed shovel.

The bottom width of the ditch should always be staked out at least 200 feet in advance of the construction crew. The section of the ditch is then roughed out with vertical sides to the approximate depth.

The following method for checking the grade of a ditch is simple, cheap, and accurate and has been used with considerable success in the field with foremen and labor who are new to this type of work: The foreman drives poles on each side of the ditch opposite each grade stake. He then measures the vertical distance from the ground to his eye; for illustration, suppose this distance is 5.1 feet. The foreman then marks a point on each pole 5.1 feet above the grade of the proposed ditch, using the figures from the grade sheet under "cut stake" for that particular station. For example, if the "cut stake" figure is 4.1 feet at a station, then he levels over to the pole and measures up 1.0 feet above the elevation of the top of the stake and marks the pole. Strings are then stretched across the ditch to the pole on the opposite side at each station. All strings are exactly 5.1 feet above the grade of the proposed ditch. The foreman can now check the grade of the ditch at any point by determining if two or more strings coincide with his line of sight when he stands erect in the ditch.

It is good practice for the finishing crew to use a template in checking the side slope. It need only be used at intervals of 25 feet.

Laying Tile

The first operation in the laying of tile is to construct a trench to grade. Batten boards are set across the trench at intervals of 25 feet with their top edges at a constant height above the flow line of the tile, and the line is marked by a nail driven in the top of the batten board. The grade of the trench is checked by means of a rod divided into feet and tenths.

The tile are laid with the bells pointing upstream, beginning at the outlet. Each joint must be laid on line and to grade and should be firmly embedded in the bottom of the trench. An accurate method for checking the tile is to attach an eight inch steel angle iron to the measuring rod so that the angle may be inserted into the mouth of each joint and checked from the line stretched over the batten boards.

Brick in Bridge Construction

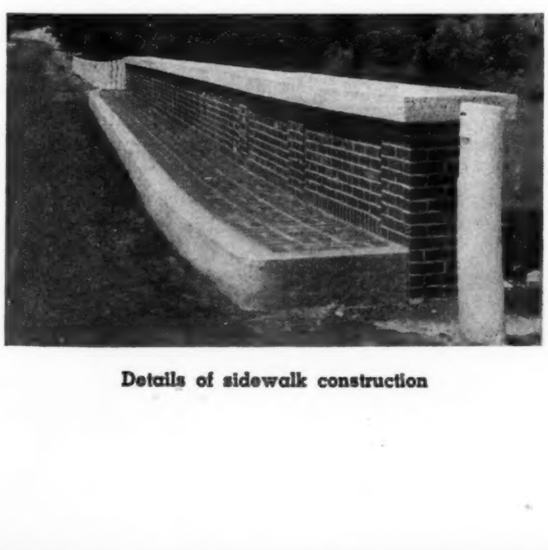
Brick-faced bridge on New Hampshire Route 101 at West Epping

IN an attempt further to beautify the already beautiful highways of New Hampshire, the highway department of that state has been using both granite and brick veneers on their bridges. Both are local materials and both furnish added beauty and adequate protection against the elements. The cost of the brick veneer is sufficiently less than the granite veneer, however, to warrant the preferred use of the former. As an illustration of such construction, a description is given of a bridge on the cross-state highway, route 101, running from Portsmouth to Keene, N. H., spanning the Lamprey river at West Epping.

This bridge is of rigid frame reinforced concrete construction, having a span of 38 feet 8 inches on a 26½ degree skew. The roadway is 24 feet wide, flanked by brick safety walks 2 feet 8 inches wide. The guard rails, also of brick veneer on reinforced concrete construction, rise 2 feet 7 inches above the sidewalks, which in turn are 9 inches above the level of the finished roadway.

Standard methods were used in the rigid-frame reinforced concrete structure which was used as the base for the brick veneer. Forms were set so that horizontal shelves or ledges to support the brick were left on the wingwalls, a little below the levels indicated for the fill and stepped up from the waterline toward the ends of the bridge, so that the fill covered all concrete, leaving only the brickwork exposed.

In laying up the brick on these shelves, further support was given by heavy copper ties placed 18 inches on center horizontally and in every fourth course vertically. Over the arch, these ties were doubled in number for greater bonding strength, although the 2-foot camber of the arch was sufficient in that length of span to create a true arch action. The brickwork was set out a half inch from the face of the concrete and this space was thoroughly filled with mortar to provide additional strength in bond.



Details of sidewalk construction

The brick was laid with running bond, with some pattern work used to relieve the otherwise plain surface. For instance, the arch and the roadbed were defined by the use of soldier and header courses; the arch being formed of two soldier courses and a header course, and the line at the level of the road consisting of a belt course of headers. As a frame for the arch, pilasters were built out two inches on either side, with the top consisting of a corbel built out the two inches in four courses, this corbelling supporting the belt course at the road line mentioned previously. Directly over this, on both the outside and the inside of the guard rail, panelling consisting of panels four feet wide separated by 16-inch piers, was surmounted by another soldier course which supported the coping.

This architectural treatment of the brickwork was simple, but very effective. The only thing that should be watched particularly in laying out a job of this character is the dimensions of the panels and piers. Care should be taken that these dimensions fit the size of brick which is selected, as otherwise considerable cutting and fitting may be necessary.

The brick were of the water struck type, manufactured locally, of dark red color obtained naturally, and with a texture which is found only in brick made by the waterstruck method, where water creases give a naturally rugged individual surface treatment.

The granite used for coping and curbing was also a local product, light gray in color, with a bushhammered texture. Its use was quite desirable from the architectural standpoint, setting off as it did the color of the brickwork which was the prominent motif of the treatment.

Below the waterline of the river, the mortar was of one part cement to 2 parts sand, which was calculated to resist any freezing and thawing action and prevent the seepage of moisture into the brick. Such a rich mixture would not be recommended for ordinary brickwork because of the excessive volume changes due to changes in moisture content. Here, however, it was figured that the moisture content would be more or less constant, eliminating excessive volume change and the chance that the mortar would pull away from the brickwork, thus opening up hairline cracks for the entrance of moisture. Above the waterline, the mixture was changed to one part cement, 1½ parts lime and 3 parts sand. This gave a more easily workable mix, resulting in more easily completely filled joints and a mortar mix which had less differential expansion. All joints were tooled after the mortar had partially set,

assuring complete bond with the brick at the face of the mortar.

Care was exercised in the design to prevent any possible chance of moisture carrying through the concrete or the granite into the brickwork. Flashing was placed under the granite coping, and flashing at the road level carried away from the brickwork any water that seeped in. These precautions were taken primarily to prevent efflorescence on the brickwork from the soluble salts in the concrete, but also helped in eliminating excess moisture in the brickwork which might cause trouble in freezing weather.

The sidewalk construction, where brick were used for the paving, consisted of a fill built up from the rough top of the concrete structure, on which was placed a half-inch of mortar, the brick being set in a basket weave pattern on this bed of mortar.

The contract price for this veneer was $70 per thousand, which gives a cost per square foot of approximately 42c—considerably less expensive than for any other type of masonry veneer. The West Epping Bridge was built by the Lane Construction Company, New Haven, Connecticut, under the immediate supervision of Clayton Chase, resident engineer for the state. H. E. Everett, commissioner of highways, Daniel H. Dickinson of the firm of Morse, Dickinson and Goodwin, chief engineer, John Childs, bridge engineer, and H. E. Langley, were in charge of the design and construction.

Brick reinforcing and also solid brick work have been used in several other states. In Ohio, a bridge was constructed at Sugar Creek, Tuscarawas County, in 1934, using reinforced brick masonry for the piers and abutments, and brick veneer on reinforced concrete for the superstructure, and a contract was let March 31st of this year for another bridge of similar construction. At Perla, Arkansas, a bridge using reinforced brick masonry abutments and wing walls and steel girders was built in 1934. The State Highway Department of Massachusetts has just awarded a contract to Ellsworth Lewis for the construction of an overpass of brick veneer construction at Lynnfield on the Newburyport Turnpike. In Connecticut consideration is being given the proposal to use brick masonry surance rate on brick mercantile buildings dropped 34% advantages claimed for the use of brick are beauty, permanence and low cost for both construction and maintenance.

Waterworks Construction Causes Reduced Insurance Rates

Building of new water works systems by the PWA has resulted in lowering the local fire insurance rates, according to a recent survey covering three states—South Carolina, West Virginia and Ohio—which were selected as fairly representative.

Fire insurance rates in South Carolina were so high that the annual saving to home owners and merchants because of reductions in insurance rates due to the water protection in many instances will equal or exceed the entire annual water bill. In the 28 cities and towns where PWA has completed water systems the insurance rate on brick mercantile buildings dropped 34%, on mercantile frame buildings 10%, on brick dwellings 43% and on frame dwellings 36%.

In 12 towns in West Virginia the reduction for mercantile buildings is 24% for brick and 16% for frame; and for residences, 46% for brick and 43% for frame.

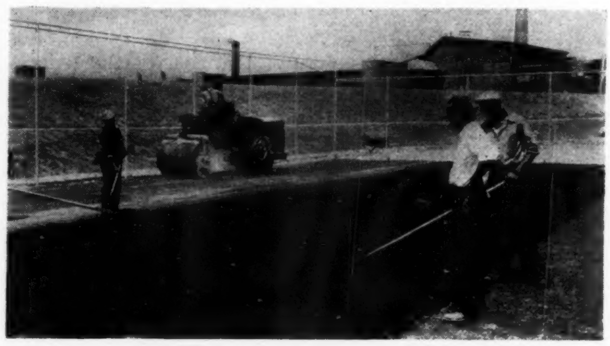
In Ohio, 17 PWA water works have been completed and 34 are under construction. In the case of brick residences as much as 50% has been saved in rates, and a maximum of 43% for frame dwellings.

While possibly only comparatively few in these waterless towns carried insurance and so will profit directly by these reduced rates, the lowered rates will probably induce many more to insure and to profit by many times the premium in case of fire.

Trenton Builds Asphalt Tennis Courts

ASPHALT surfacing was adopted for the 35 tennis courts that Trenton, N. J., has just completed. The surfacing is similar to that used on asphalt streets. It is resilient, free from dust, dries quickly after a rain and withstands easily the hard service that courts in playground areas receive.

The excavation and foundation work for the courts was done by WPA labor under the direction of P. N. Daniels, Federal Works Projects Engineer for the City of Trenton. The foundation consisted of 4-inch rolled waterbound macadam. The Union Paving Company of Philadelphia, which was awarded the contract for mixing and laying the binder and wearing surfaces on these courts at a price of $1.59 per square yard, prepared the mixtures at its plant in Trenton, assuring a more uniform quality of the mixtures than if they had been prepared on the different jobs. Inspection of the bituminous mixtures used for the binder and wearing surface was under the direct supervision of L. D. Long of the Jersey Testing Laboratories, Newark, N. J.



Tennis court under construction. At right, binder course. Middle—wearing surface ready for rolling. Rear—rolling

A binder course, consisting of crushed stone, sand and Trinidad Lake asphalt cement, was mixed hot, hauled to the job and compacted to a thickness of 1½ inches. A wearing surface composed of sand, crushed stone and stone dust, and asphalt cement of 60 to 70 penetration was also mixed hot, hauled to the job and compacted to a thickness of 1¼ inches with heavy rollers until the wearing surface was absolutely level.

In all, 23,706 square yards of surfacing was laid on the thirty-five courts in the five different playground areas throughout the city. The largest number of courts was installed at the Trenton High School athletic field, where fifteen courts were constructed, having a total area of 10,666 square yards. Sixteen other courts, with a total area of 12,950 square yards, were constructed in parks and playgrounds scattered throughout the city.

Hot dip (after forming) galvanized iron fencing, ranging from 10 ft. to 12 ft. in height, was used at the ends, sides and partitions of the courts. Iron posts fitted with ratchets, which make for ease of tightening nets, were used on all the tennis courts.

This work was carried on under the direction of Joseph E. English, Director of Public Works and Service of Trenton.

Oskaloosa's Sewage Treatment Plant

OSKALOOSA, Iowa, this year completed two sewage treatment plants, one of the unusual features of which is that they are practically identical except for differences in arrangement of the several units necessitated by the topography of the plant sites.

The city lies on high ground, a ridge running from the northwest corner to the southeast and another natural divide from the northeast to the southwest, thus dividing the city into four drainage areas. The Des Moines river flow from the southwest corner and the Skunk river from the northeast, and furnish outlets for two plants placed just inside the city limits at these points. The sewage from the northwest drainage area is pumped, with a 44-ft. lift, over the divide into the southwest plant; that from the southeast area is carried by gravity in a 15-in. sewer to the northeast plant and there lifted 10.5 ft. into the plant.

There was already a treatment plant at the northeast site which treated about 40% of the city's sewage. This was changed and enlarged to treat 50%, the other 50% going to the other plant. Originally all storm water was carried in the sanitary sewers, but about 1910 a program of separation by building storm sewers was started and practically completed in 1935. Since the fall of 1933, 3.29 miles of storm sewer has been completed under CWA and FERA at a cost of approximately $45,000. There are still a great many roof water connections to the sanitary system which must be changed over to the storm sewers.

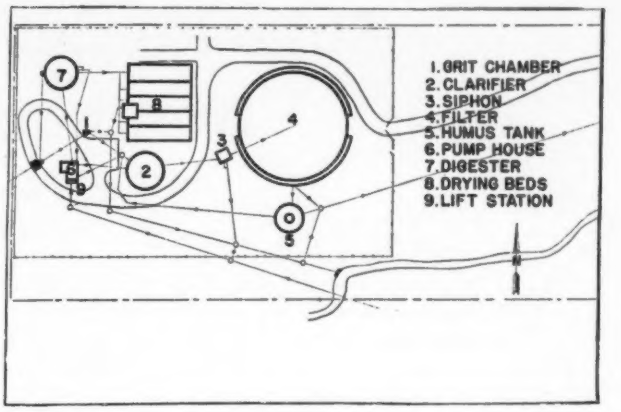
Each of the plants consists of a grit and screen chamber, primary settling tank, sprinkling filter, final settling tank, digestion tank, drying beds and pump house.

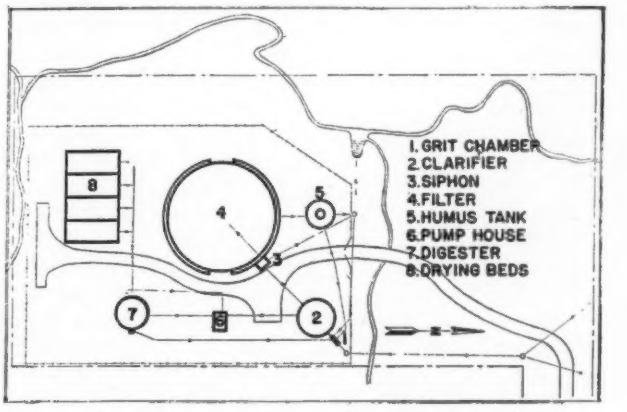
Material intercepted by the grit and screen chamber is removed by hand and buried. The chamber is provided with a bypass for use when repairs are necessary, and an overflow for excess sewage.

The primary tank is circular, 35 ft. in diameter and 5 ft. 6 in. to 6 ft. 10 in. in depth. The effluent is removed in an 18-in. gutter which surrounds the tank on the outside. The sewage enters a central suspended stilling well tangentially, giving a spiral flow which reduces the velocity, and flows out under the bottom of the well. The sludge which settles is pushed over the floor to a central well by brass squeeges on revolving arms, while a revolving skimming device removes floating matter, both of which are pumped into the digester.

The primary tank effluent flows to a dosing tank 15 ft. square which serves a rotary sprinkler on a filter 125 ft. diameter with an average depth of 7 ft. 9 in. Around the outside of the filter is a gallery, that part of which above the filter floor serves as an inspection gallery while an extension below the floor is used as an outlet gallery for removing the effluent.

The filter effluent flows to a final settling tank (or through a bypass direct to the creek) which is round, 35 ft. diameter. The wall is vertical for a depth of 11 ft. 3 in. (only 4 ft. of which, however, is water depth)





Oskaloosa sewage treatment plants
Top—Northeast plant. Bottom—Southwest plant

and the bottom is cone-shaped with the center 13 ft. 6 in. below the bottom of the side wall or 24 ft. 9 in. below the surface. In this tank, also, the influent enters a suspended metal cylinder or stilling well, under which it passes and overflows into a white tiled trough weir on the inside of the wall. The settled solids slide down the sides of the cone to a central well, from which they are pumped to the screen chamber.

The final effluent is used for washing and flushing all units of the plant, sprinkling lawns and beds, for wash and toilet purposes and for the hot water boiler, a pump at the final settling tank forcing it through a water main for these purposes.

The digestion tank is circular, 35 ft. diameter and 20 ft. deep, with a fixed cover of concrete, provided with a steel gas dome. Stirring arms at both top and bottom revolve on a central shaft. Gas from this tank is used for heating water for heating the digester sludge; also heating the pump house, which contains the laboratory, toilet, etc., as well as the pump which draws the sludge from the primary tank to the digester and circulates it in the latter.

The digested sludge is dried on open beds of sand or gravel.

These two plants, including the lift station, cost $146,290 by contract awarded to McKey & Fansher Co. on Dec. 1, 1934, which completed the construction on Feb. 17, 1936. The outfall sewers totaling 3.1 miles were built by the city engineer as a FERA and WPA project at a cost of $44,500, of which the city contributed about $10,000. The disposal plant site improvements—attendants' houses, roads, fences, bridges and landscaping—cost $32,118.

The consulting engineer for the plant was Lafe Higgins, Jr. Don B. Russell, to whom we are indebted for the information, is city engineer.

Rhinelander Revises House Numbering System

By THEODORE M. WARDWELL
City Manager, Rhinelander, Wis.

A MUCH needed and worthwhile project consisting of renumbering of all property in the city was recently completed as a WPA project. Much confusion and irregularity existed in the old numbers due to a lack of a master plan.

The first step in the proceedings was the passage of an ordinance specifying the method of numbering and establishing a new base line for the north and south numbering. The old base line was not a through street and was not geographically the logical location for a base line. The east and west base line was unchanged. It was also provided that a number for each ten feet of frontage in the business district be assigned and a number for each twenty feet in all other districts. Formerly the twenty foot rule applied throughout the city, resulting in some trouble in the business districts where doorways were close together. The ordinance also provides for the type of number to be installed, which is identical with those used in the city of Milwaukee.

We decided that the city would pay for our share of the costs as a general expense and not assess the cost of numbers to individual property owners. A WPA project application was submitted on the basis of the city furnishing half the cost of the numbers and the WPA the other half plus all labor.

Four men were used in the preliminary field work. Two handled the measuring tape, one recorded the information needed, and a supervisor was in general charge. An individual card was made out for each doorway containing the following information: 1. Street name; 2. Present number; 3. New number (filled in later in office); 4. Owner; 5. Whether door led to up or downstair premises; 6. Lot; 7. Block; 8. Addition; 9. Distance from corner or measuring point to doorway (nearest foot); 10. Description of measuring point (ex., south line of Davenport St.); 11. Which side of street (i.e., right or left). In addition we also obtained the name of renters if possible.

The cards were then brought into the office and checked for description, ownership, and errors and from a prepared chart the new number was obtained and entered. Cards were then indexed by streets and in numerical order of new numbers. After all cards were indexed, the workers started tabulating the total number of digits required as well as the number of frames. The numbers are in the form of individual digits inserted in a suitable frame. For example the number 246 would consist of one digit each of the numbers 2,4,6, to be inserted in a three-number frame. We followed the same system used in counting election ballots in counting digits and frames. In fact we used some old election tally sheets for this purpose, inserting the figures and frames in place of the names of candidates. One man read the numbers, each digit separately, and two tabulators recorded them, the same process being used for the frames.

The grand total including some extras which we carry on hand for new buildings came to 6,834 digits and 2,290 frames. The WPA purchased 3,285 digits and 1,096 frames and the city the rest, including screws for attaching numbers.

After the numbers were received they were assembled in the office by streets and a crew of three placed them on the buildings. An automatic drill and screw driver were used to attach the numbers and galvanized screws one inch long were used.

While waiting for the material to arrive we had NYA typists make up six copies of the information contained on the cards. Copies of these lists were furnished to all public utilities so that they could correct their mailing lists.

The WPA and the city purchased the digits and frames at the same figure, which was nine cents each for digits and an average of about 12 cents each for various size frames.

A fine public reaction greeted this project. We now have a systematic and accurate numbering system, with uniform numbers for everybody that are easily seen and read, which combined with our new street signs makes it easy for anyone to find their way around.

The above work was described in *Wisconsin Municipalities,* from which this article is taken. Rhinelander also took advantage of the NYA program to make and erect street signs. This work consisted of making and erecting at each intersection painted wood street name signs. These signs were constructed of ordinary 1"x4" dimension lumber, painted yellow and the street names painted on these boards in black. One set of signs were erected at each intersection by nailing the boards to telephone or electric light poles at right angles to each other with the adjoining ends flush and nailed together. Approximately 200 two-way signs were erected at an approximate cost of $15.00 for lumber and $10.00 for paint and incidentals, or approximately 12½ cents per set for materials. It is not expected that these signs can give a very long period of service but the small expense well warranted the undertaking. This project can be well done in the winter if painting can be done inside. All materials were furnished by the city.

A 600-Inch Rainfall

Last week, while weathermen in continental America were totting up the broken drought records of the Middle West, their colleagues in Hawaii were beginning to plan their annual ascent to one of the world's wettest spots, the top of Mt. Waialeale, in the middle of the Island of Kaui.

The average rainfall there piles up to the impressive figure of 450 inches or more, while in some rainy years it has been as high as 600 inches.

To keep an accurate record of this extraordinary rainfall, a huge rain-gage, bigger than a barrel, has been set on the mountain-top. It will take care of 900 inches of rainfall without overflowing. The gage is read only once a year because it is such a nuisance to get to the summit of Waialeale. Most of the way must be hacked through dense, wet, matted trees, shrubs and vines, trickling with numerous rivulets. Ascending weathermen often get stuck in the mud.

At the base of this 5,000-foot mountain, the annual rainfall is only about eleven inches—the same as in the drier parts of Arizona.—*The "Literary Digest."*

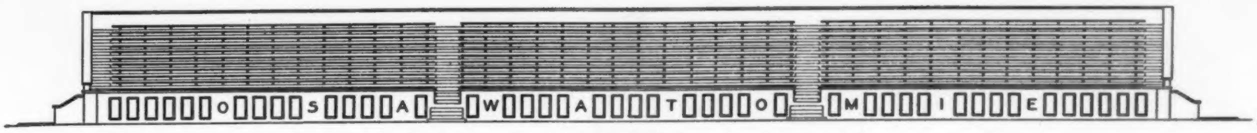


Fig. 1—Front view of Osawatomie grand stand

Grandstands for Athletic Fields

By HARRY J. ABBEY
Registered Professional Engineer

Figuratively speaking, from the standpoint of athletic facilities, I was reared on hominy grits and bacon. The hominy grits in the form of flint hard pan, and the bacon—well, we usually failed to bring it home. This situation was true for all who grew up in small towns in years gone by. It is still true for many small and middle sized towns, but not for all.

It is one of my pet ambitions to see not only two chickens for every pot but an athletic field for every small town and every neighborhood in the larger cities. We who ran for touchdowns over such hazards as drainage ditches and rock piles; who kicked off from the top of a rotting stump; would like to see our boys have more satisfactory gridirons.

THE construction of playgrounds and athletic fields is unusually desirable from the standpoint of the Works Progress Administration. Such work carries a high man-month element; it interferes with no established line of building specialists; there is no association of athletic field builders, and therefore no organized lobby to combat such construction as a social welfare program; it offers work for a number of trades as well as for common labor, and much of it can be done by the older and crippled men.

There is likewise a latitude of possible sponsors. If the city is unable or disinclined, a school district may act as sponsor. Park Boards have sponsored several projects in my locality.

The plants on which I have served as engineer have been of various seating capacity from one to three thousand. All have been either rubble masonry with reinforced concrete decks, or all reinforced concrete.

Rubble masonry is desirable construction from a work relief viewpoint. Reinforced concrete column and girder construction is the most economical, but the ratio of material cost to labor cost is high, while the same ratio for rubble masonry is low. The material cost for reinforced concrete is approximately 50 per cent of the total cost, while for rubble masonry the materials as a rule amount to not more than 20 per cent of the total cost.

The design loads for these structures should correspond with those used for auditoriums and gymnasiums. Young people attending football games cannot be expected to refrain from imparting impact loads to the slabs on which they sit—or jump. Even in structures in which I am positive that conservative results have been arrived at, I have often shuddered when a thousand jubilant kids leaped to their feet in a single unit. If you wish to remain complacent enough to enjoy the game under these circumstances, I would say you should design for a live load of no less than one hundred and twenty-five pounds per square foot. If proper inspection is not a sure thing, this figure must be revised upwards accordingly.

The structures shown in pictures accompanying this article were built by day labor methods as relief jobs. Whatever you may hear said about the quality of relief work, these are well constructed units. They stand as monuments to the versatility of the American workman. Miners, railroaders and glass blowers were converted into stone masons, concrete finishers and form setters. No trouble will be encountered in getting a day's work out of a man if the man is put on a job where he can see that something is being accomplished. While attending a night soft-ball game last week I was pleased to see a relief worker pointing out with pardonable pride the merits of the structure he had assisted in building. At the same time, one of a large family of children explained to another child that dad had rubbed the concrete for hours so it would be nice and white and glistening under the flood lights.

These structures standing alone, without considering the cost of acquiring and grading the playing field, have cost from eight to twenty-four thousand dollars each. This means from six to eight dollars per seat.

The seating capacity should as a rule be much larger than enough to accommodate the usual crowd attending your events. Experience has shown that a comfortable seat where one may easily see everything that goes on will double the size of the crowd. The addition of flood lights will permit working people to come out for the games and triple the size of the crowd.

The accompanying drawings show the details of construction on one of these structures. The appearance, span lengths, etc., differ for different sizes of stands but the general design features for all are practically

Fig. 2—Typical stone masonry structure, Paola, Kans.

Typical all reinforced concrete, Osawatomie, Kans.

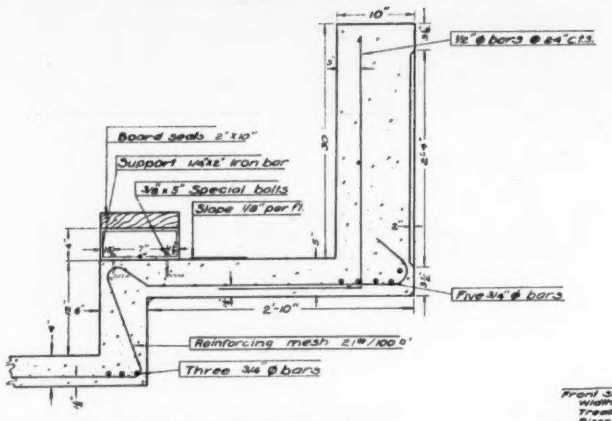


Fig. 5—Detail of superstructure

alike. If the data found thereon are of any value to members of the profession, they are quite welcome to use them in any way they may desire. If this article should perhaps stimulate some one reader to go out and promote an athletic field for the boys in his town, I will be repaid a thousand times for my efforts in submitting this article.

Structures of this nature are largely utilitarian in purpose and use but there is no reason why they should not be made attractive. The services of an architect could and sould be used in the general proportioning. Most members of the civil branches do not realize what a little paneling or other architectural treatment adds to a structure, and it adds little if any to the total cost.

A general view of the front of the stadium built at Osawatomie, Kans., is shown herewith. This is 169 ft. 4 inches in overall length, exclusive of the entrance wings at the ends. The structure is carried on 9 sets of supports, which are spaced 21 ft. on centers. Each set of supports consists of three 14-inch square posts, carrying an inclined reinforced concrete beam 30 inches deep and 18 inches wide. This construction is shown in Fig. 3. The beams are reinforced with four 1-inch round bars. The posts are placed on footings 12 inches thick and 6 feet square, which are reinforced with ½-inch round bars spaced 6 inches centers both ways. The posts are reinforced with ¾-inch round bars, placed at the corners, this reinforcement extending into the footings. The general dimensions of the supports are shown in Fig. 3.

Fig. 4 shows the construction between supports, and Fig. 5 the details for the top seat and rear. The risers between the seat levels act as beams, these being 16 inches deep, 6 inches thick and reinforced with three ¾-inch round bars. There are 12 rows of seats consisting of 2 x 10 boards placed on iron supports which raise the boards 4 inches from the floor. The risers are 12 inches high; the treads 2 ft. 6 in. wide.

There are four aisles, one at either end and two spaced so as to divide the stadium into three seating sections. Center aisles are 4 ft. wide. The end aisle steps are 3 ft. 1 in. wide; the center aisles 3 ft. 8 in. All risers on aisle steps are 6 inches, and treads 15 in.

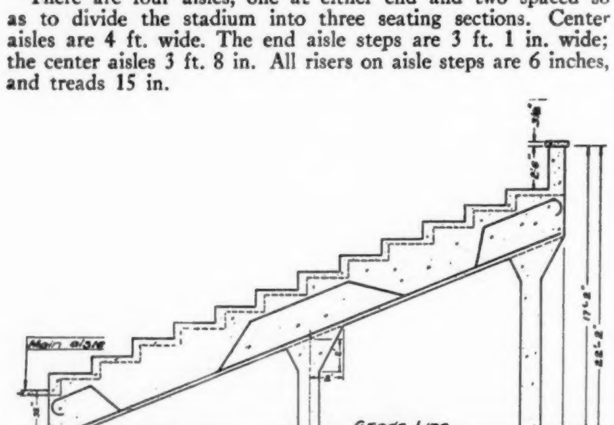


Fig. 3—Section through structure at supports

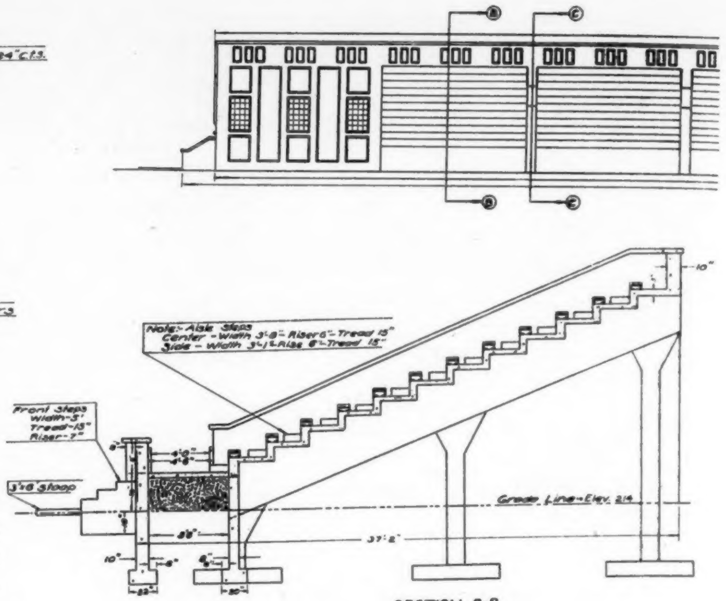


Fig. 4—Above—rear view of one end of stadium. Below—Construction between supports

The end walls are paneled, as shown in the photograph, Fig. 2. An entrance at each end is provided with a steel door, 2 ft. 8 in. by 7 ft.; windows 2 ft. 8 in. by 4 ft. 8 in. are provided at both ends, the arrangement being shown in Fig. 4. Panels are placed above and below these windows, and between them. All panels are 2 inches deep with 45° sides. Panels are spaced 6 inches from doors, windows or other panels. Asphalt joints are placed between the stadium and all exterior step structures.

The material required for this reinforced concrete stadium included the following: 373 cu. yds. of concrete; 27,680 pounds of reinforcing steel, bars and mesh; 3,040 board feet of 2 x 10 boards for seats; 960 ft. ¼" x 2" iron bar seat supports; 400 ft. of ⅜-in. round steel bars for special bolts for fastening seat supports; and one 24 x 30 tablet, which was set in a panel near one of the entrances.

Tests With Dust-laying Agents in Sweden

During a period of ten weeks in the summer of 1934, various dust-laying materials, including calcium chloride, sulphite liquor and a number of oils and oil emulsions, were tested on a road which had a foundation of stone pitching 8 in. to 12 in. thick, an intermediate course of macadam 4 in. thick, and a 2-in. gravel surfacing. Satisfactory results were obtained with calcium chloride and sulphite liquor but the oils and oil emulsions gave varying results. The treated sections, it was found, had two types of surface, which were not, however, very clearly distinguished. Either a skin was formed by the non-volatile material cementing together the stone particles, or else there was no skin but the relatively volatile material adhered to the dust particles and kept them on the surface. In the former case, potholes usually were gradually developed and planing of the surface could not take place. In the latter, the surface tended less to form potholes and more to corrugate. Although none of the oils or oil emulsions tested was entirely satisfactory, those forming a skin would appear to be the more effective. In general the most suitable dust-laying material would appear to be one which, when the volatile constituents or other admixtures had vanished, would leave a certain minimum residue of dust-binding material on the surface, which would remain soft and allow planing of the surface to take place. Repeated treatment with such material should cause a thick mat to be formed in time, which would not easily be cracked.—*Road Abstracts:* S. HALLBERG: *Statens Väginstitut, Meddelande* 51. Stockholm, 1936.

Winter Chlorination of Small Water Supplies

An inexpensive chlorinator house suitable for the small supply.

SOME operators feel that it is not necessary to keep the chlorinator running in winter. This is an erroneous opinion. Winter weather in the temperate zone freezes the ground and all surface wash arrives at the reservoir quickly without the benefit of natural purification. During long cold spells pollution accumulates and with the first thaw, may be washed to the reservoir or intake at once. This is probably the most dangerous time and the time when chlorinator is most needed. Bacteria live longer in cold weather and natural purification forces are slowed down or completely eliminated, making it necessary to depend on chlorination, or filtration plus chlorination, almost entirely.

Uniformity of temperature in the chlorinator room is of utmost importance if good results are to be expected of chlorinators. In all chlorinators, regardless of type, the first operation performed is the reduction of the cylinder pressure to a uniform lower pressure and in vacuum chlorinators this initial pressure is reduced to a partial vacuum. The small valve performing this function must be kept clean. When this valve fouls, nine times out of ten the trouble was caused by improper temperature conditions.

Impurities in chlorine gas, even though present in small quantities, are chiefly responsible. It is only the volatile impurities that cause the trouble. They pass easily through the lines leading to the apparatus and even through filters. The drop in pressure and the resultant drop in temperature at the reducing valve cause these volatile impurities to be deposited at the inlet valve, or at any point where the temperature drops sufficiently.

When the temperature in the chlorinator room drops, the small tube connecting the tank with the chlorinator, being small in bulk, is the first to feel the change. The large body of liquid chlorine in the cylinder will change temperature slowly, maintaining a pressure in the tube corresponding to a higher temperature than actually exists. The result will be that small drops of liquid chlorine will form on the walls of the tube and will be worked along to the inlet valve, effectively putting it out of operation. Both of these difficulties are caused by improper heating, and both can be prevented by relatively simple precautions.

Isolated chlorinator houses should be substantially constructed and well insulated. They should be located directly over the main if possible, and a vault constructed around the main, serving also as a foundation for the building. For a direct-feed installation, the minimum inside dimensions should be 6′ x 6′. Windows are not necessary and are more of a liability than an asset. Two doors should be provided, the outer one being solid and substantial and the inner one having a large glass sash. The outer door provides protection from vandals and the inner door is to provide light for the operator on his periodic inspections, without unduly chilling the room in cold weather. The photograph illustrates this clearly. Where an ammoniator is used, the house will have to be larger to accommodate the large ammonia cylinder, which is usually set in a horizontal position and is seven feet long.

Heating

With a properly constructed and insulated building, very little heat will be required. Electric heaters with a thermostat are ideal because of the uniformity of the heat. Unfortunately, however, electricity is seldom available at the isolated installations where it is most needed. Gas compressed in steel cylinders is a convenient heat source; the major difficulty with this type of fuel is in the control. The small quantity needed makes the use of a thermostat impractical except for the larger houses. At one installation the operator has rigged up a control based on the temperature control used in chicken brooders. A large-area, delicately balanced sheet iron damper is built into a ventilator in the roof. When the room gets too warm the buoyancy of the warm air opens the damper, letting some escape and replacing it with cool air admitted through vents near the floor. If well made, this control will work satisfactorily, and could be used with any other form of heat.

Kerosene oil is much used for this work because of its convenience. Some operators have used regular oil stoves and added an enlarged reservoir in the base so that it need be filled only at longer intervals. The standard stove will burn only about 24 hours. When kerosene is used, care must be taken to prevent fires. If the stove is located over an open body of water, such as in a gate house, it is advisable to build a shallow metal pan under the stove to catch any drippings. Kerosene and chlorine in water combine to produce a bad taste. Light furnace oil can be used and there are several good heaters available for this fuel. It is cheaper than kerosene and less liable to cause a fire due to its higher ignition point. Small fuel tanks can be set up outside the building and the oil piped to the heater, making it unnecessary to fill the heater inside the house. Both this type of heater and the regular kerosene oil stove are too large for the small chlorinator house if it is well insulated. Many operators find that an ordinary trainman's lantern hung up on the chlorinator or immediately below it gives sufficient heat for all except extreme weather, when two lanterns will usually do.

Coal stoves are the least satisfactory of all. With inspections made only once a day it is impossible to burn a coal fire evenly at the low rates required.

Ventilation is required in all houses except those heated with electricity. A 3-inch ventilator in the roof and two or three 1-inch holes in the door near the floor are sufficient.

Regardless of the type of heat used, uniformity of

heat is the important thing. The cylinder should always be cooler than the apparatus, and therefore be kept away from the heat source.

During winter months, the cold water chills the diffuser to the point where gum from the chlorine is apt to condense and choke the diffuser tip. The following method of opening this choked tip has been used several times and is much easier and quicker than removing the diffuser. Loosen the stuffing nut around the diffuser shaft and withdraw the shaft half way. With a blow torch warm the shaft very carefully. Never heat it so that you can not bear your hand on it or it will affect the packing. Silver conducts heat rapidly and will conduct it to the diffuser tip. Usually it will only be a moment before you will hear the accumulated gas rushing through the opened tip.

Every fall there is an epidemic of chlorinator troubles. Most of these are caused by temperature change from day to night. Operators fail to realize that the nights are getting cooler more rapidly than the days. During this period it is advisable wherever possible to light a lantern each night and place it near the chlorinator, extinguishing it each morning.

With direct-feed apparatus little harm is done to the apparatus if the heat fails; but where solution-feed is used, a freeze-up will cost real money. Houses for solution feed equipment, particularly when pumps also are used, are large enough so that heating is less of a problem.

Any repairs on your apparatus that you feel to be necessary should be made before the cold weather arrives. Clean the diffuser of a direct-feed machine and the line leading to it. This can best be done with chloroform, although wood alcohol will do. Clean the inlet valve and tank connection and make sure that the inlet valve is working perfectly. Check over your supply of spare parts, gaskets, wrenches, manometer liquid, etc. Most jobs on chlorinators can be performed easily and quickly if suitable tools and spare parts are on hand. It is false economy to be without them. In winter it is sometimes a real job to get to the chlorinator house and a return trip to get a wrench or a spare part locked up in the safe at the village clerk's office makes it doubly so.

Making tests for residual chlorine is just as essential in winter as in summer. Where the test tap is located in the open, down the line from the house, see that it is protected from freezing so that tests can be made as required. Where hydraulic conditions permit, a return line should be run from a tap fifty feet below the point of application to the house so the test can be made inside. Where both ammonia and chlorine are used, the test can be made daily at the operator's home or at any other convenient place in the village.

Scour of a Sandy River Bed by Clear and by Muddy Water

At the request of the U. S. Bureau of Reclamation an experimental study was made in the hydraulic laboratory of the National Bureau of Standards of tne scour produced in a bed of fine sand in a sloping flume by muddy water, as compared to clear water. The experimental conditions simulated those existing in the Colorado river at the Boulder Dam before and after construction. It was found that, when the water contained an appreciable amount of clay in suspension, an increase of about ten per cent in mean velocity of the water was necessary to scour out the same amount of Colorado sand as was scoured by clear water. For coarser sands this increase in velocity was greater.

Velocities characteristic of critical movement of the sand bed were found greater for muddy water than for clear water.

It was concluded that clear water discharged at the Boulder Dam will cause more scour of the river bed below the dam than the muddy water of the river before the dam was built.

The complete report of this investigation was published in the August issue of the *Journal of Research.*

Hartford's Water Leakage and Waste Survey

THE Water Bureau of the Hartford (Conn.) Metropolitan District, by means of its annual leakage and waste survey in 1935, detected and stopped leakage amounting to 174,000 gpd. The Pitometer Co. made a survey in 1924, and similar surveys have been continued by the water bureau since then, resulting in a total aggregate leakage stopped since that date of 4,087,000 gpd. Caleb Mills Saville, manager and chief engineer of the Water Bureau, reported on this work as follows:

In 1935, two engineers and three laborers were assigned to field work connected with the annual leakage and waste survey, which started on April 30 and was completed on October 28.

Measurements were made of the flow of water into the 36 districts into which the distribution system is divided, to determine the ratio of the minimum night rate to the twenty-four-hour rate. Four dstricts, showing ratios in excess of 50%, were sub-divided and investigated in detail for possible leakage.

The two 42" supply mains from the filtered water basins into the city were checked, as were the two 20" mains in Farmington Avenue. All four mains were in very satisfactory condition, with no indication of large leakage.

The registration of the two 42" x 18" Venturi meters was checked and found to be essentially correct.

The total leakage detected and stopped amounted to 174,000 gallons per day. Of this leakage, 90,000 gallons per day were due to a leak in the bottom case of a meter at Colt's factory, 35,000 gallons per day in a hydrant joint, and 49,000 gallons per day in a broken service. The total aggregate leakage stopped in these surveys since 1924 now amounts to 4,087,000 gallons per day.

The effectiveness of waste survey work is evident from a study of minimum night rates. In 1923, the year prior to the beginning of this work, the average of minimum night rates, which is a reliable index of waste, stood at about 8.00 m.g.d. In 1924, the year of the first survey, this rate dropped to 7.00 m.g.d. and in the eleven years following, it has increased to only 7.35 m.g.d. notwithstanding the likelihood of greater leakage naturally expected from a system with 70% more main pipe and about 50% more services and hydrants in use.

Quite as important as the detection of leakage is the information gained as to the operating conditions of gates and hydrants. Over 1,100 gates were operated in the course of the work, including all the large gates on the 42" supply mains, and at the cross-connection at Reservoir No. 1. Twenty-two gates were repacked, and the following defective conditions were reported and corrected: loose operating nuts on two gates, a 6" gate found closed and broken, a 16" gate with a bent spindle, and an important 24" gate on Jewell Street, near the center of the conflagration area, which could not be closed tight on account of a badly corroded seat. Twenty gate casings were raised to street grade, and two hydrants were found to be in poor operating condition.

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The City of Evanston, Ill., uses 4 International Model I-12 Tractors to clean sidewalks.

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The efficient Model T-40 TracTracTor proved invaluable to Racine County, Wis., during last winter's record-breaking snow.

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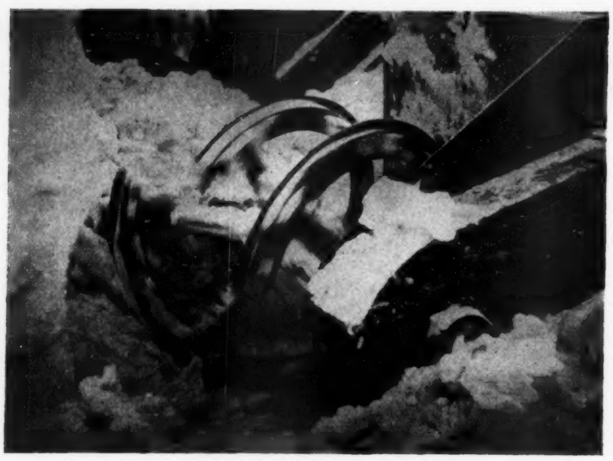

Right, Top—Trackson Company's "high shovel," both plows and loads snow. Bottom—Barber-Greene snow loader, 1936 model. At left, special feed for B. G. loader. Left, bottom—Bucyrus-Erie "Bullgrader" on International "Trac Trac Tor." Blade easily and quickly lifted or angled by hydraulic power.

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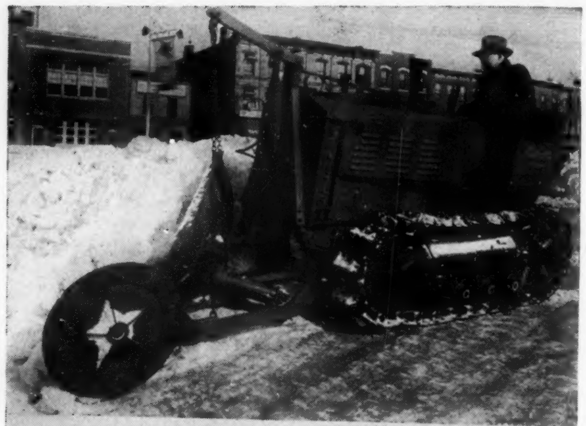
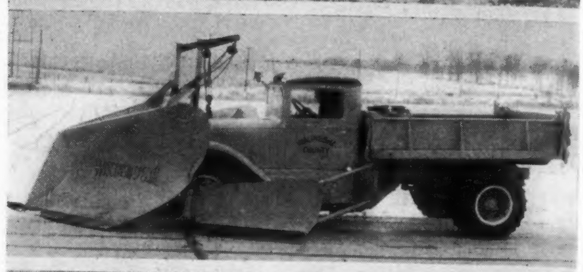
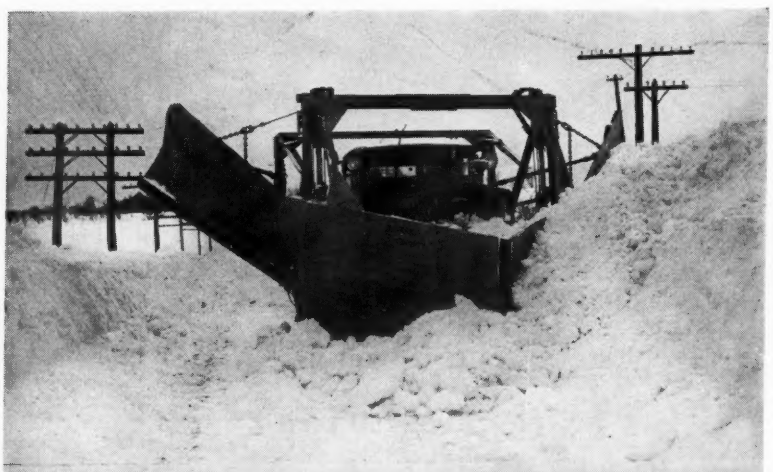




Left: Top—Baker 61 V-type plow on Ford truck on a Maine highway. Middle—Gravely sidewalk plow, clears 40" to 54" width. Bottom—Model L Traktor plowing in Grundy County, Iowa. Right: Top—Model E "Cletrac" equipped with Sargent plow; large guide wheel lifts plow over curb or obstruction. Second—Sterling FD 97 with "Wisconsin Special" plow, powered with Waukesha 100 hp engine; drump body with hydraulic hoist. Third—Walter "Snow Fighter Wrecker," front plow for deep snow, center blade removes packed snow down to road surface; carries wrecker body for emergencies. Fourth—caterpillar RD 8 and La Plant Choate plow in Cheboygan County, Wisconsin. Bottom—J. I. Case heavy-duty 4-speed tractor with Frink plow at Racine, Wis.



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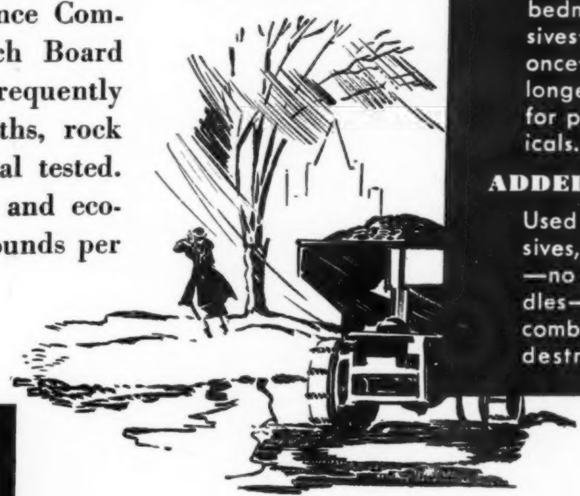

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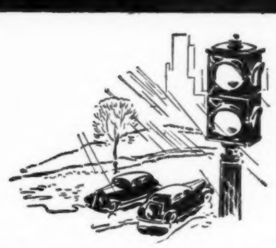
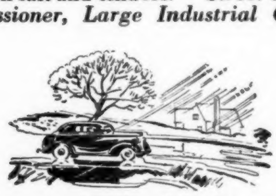


"Manholes, car tracks, etc., make it impossible to remove all snow by ploughing. We prevent ice formation by using rock salt, and make dangerous streets and crossings safe with rock salt and cinders."—*Street Commissioner, Large Industrial City.*



"I have used rock salt in connection with highway work mostly with sand for slippery roads and around culverts for forty years, and have found it very satisfactory."—*Supt. of Highways, New England City.*

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Snowdrift Control on Highways

By E. A. FINNEY
(Assistant Professor of Civil Engineering, Michigan State College)

For several years past the Engineering Experiment Station, Michigan State College, has been conducting a research on snowdrift control, including use of a wind tunnel. This article is essentially a paper read before the Twenty-second Michigan Highway Conference, giving the conclusions to date from this research, which is being continued.

SNOWDRIFTS are caused by the deposit of wind-borne snow, most of which is carried along the surface until the wind velocity becomes so reduced that it can no longer hold the snow particles in suspension. Anything, such as a barrier, which so reduces the velocity will cause drifts. On the other hand, any condition, such as elevation of road bed above the adjacent land, which increases wind velocity across it will prevent not only drifts but even normal depth of snowfall at that point.

Where barriers cause drifts, the largest amount of snow will be deposited at a point whose distance from the barrier depends upon the velocity of the wind, the tightness of the barrier and its height, and the density and texture of the snow.

Snowdrifts are caused on highways by any one of the following conditions, or a combination of two or more, namely:

1. Cut-sections and embankments
2. Grass, weeds, and vines
3. Farm fences
4. Farm and out-buildings
5. Trees and shrubs too close to the traveled way
6. Ridges paralleling the highway
7. Low-grade lines
8. Snow-plow deposits
9. Highway appurtenances
10. Rubbish, piles of earth, broken-down fences, clogged fences

The present methods of combatting the snowdrift problems may be classified under highway design, artificial snow fences, and natural snow fences.

Highway Design

The ideal position for the grade line is level with, or a little above, the average snow elevation. In this position the highway would receive the full benefit derived from the sweeping action of the wind. This method is best adapted to low, flat country, and is used quite effectively by our western states, where they try to keep their grade lines at least 18 inches above the adjacent ground level.

The shoulders, ditches, and back-slopes should be designed to provide ample storage space for the accumulation of snow from either a source of drifting or the snowplow, or both.

The cut-sections should be widened to provide storage space for snow deposits. Cut-sections from 6 inches to 6 feet seem to give the most trouble; therefore, shallow cuts should be avoided. Experiments conducted during several years past by the State College Experiment Station show that from 6 to 10 feet in width should be allowed for each foot of depth of cut. At the present time, some states have realized this fact and are providing for a minimum widening of at least 48 feet on each side of the centerline of cut-sections.

All rubbish, excess materials left from construction, ridges and brush should be removed. Existing trees should be trimmed to such height that they will not retard the motion of the wind near the surface.

Regular maintenance should secure the periodical cutting of weeds, grass and brush growing on the right of way and removal from fences of all vines, grass and tall weeds that are inaccessible to the power mowers.

Where possible, right-of-way widths should be increased to provide for the widening of cuts, erection of snow fences and planting of trees for snow control, and to take care of future expansion.

Artificial Snow Fences

Artificial snow fences may be classified into four groups—horizontal slat, vertical slat, solid and emergency.

The horizontal slat fence usually consists of 6-in. boards spaced 3 to 6 in. apart, on vertical posts either set permanently into the ground or so made as to facilitate erection and taking down. There is on the market an all-metal horizontal-slat fence, the slats being of galvanized sheet metal 6 in. wide and spaced about 6 in. apart, a V-shaped groove being pressed in the top and bottom of each slat to increase its efficiency and strength. This fence is set inclined against the wind at an angle of between 23° and 30°, which deflects the air downward and, it is claimed, keeps the fence clear of snow as well as piling it twice as high as the fence.

The vertical slat or woven picket fence is more widely used than any other, a great advantage being its ease of handling and storing. The pickets vary in width from 1 to 1½ in. and are spaced about the same distance apart. The height is usually 4 to 6 ft. but may be anything depending on local conditions. It is supported in vertical position by posts or angle iron bars driven into the ground. This fence is inexpensive and when not in use can be rolled up and stored very conveniently. Some highway departments are now using an all-metal vertical-slot snow fence, the slats being 3 in. wide with a V-shaped groove in the center, spaced about 3 in. apart on angle-iron cross members. The V-groove is to strengthen the slat and aid in the effectiveness of the fence. The fence is erected at an angle with the wind of between 20° and 30°.

The solid snow fence is simply a solid board one. It is too costly and impracticable for use in any but special cases, such as deflecting snowladen wind away from the traveled way, or on very narrow rights-of-way since most of the snow will be deposited on the windward side of the fence.

Emergency fences have been made by tying old grain or calcium chloride sacks to woven wire or chicken fencing, spacing them several inches apart.

In localities where low temperatures are continuous throughout the winter, effective snow barriers have been made by piling blocks of hard snow. Snow traps, made by plowing a ridge of snow in the fields adjacent to the highway, cause the moving snow to be deposited in trenches formed by plowing.

The proper location for a snow fence is best determined by observation of previous drifting and a study of the general topography along the roadway. Fences should be placed at all drift spots on a given road, for one or two drifted places in a road will render useless the prevention of drifts at all the other drift spots.

Sufficient snow fence should be provided at each drift spot to fully protect the road. If the stretch of fence is

too short, snow may drift around the ends and cause serious trouble, which is most liable to occur when the wind is shifting. In localities of heavy snowfall, two or more parallel rows of fence have been used, set far enough apart—75 to 100 ft. or more—so that the drifts will not overlap.

The distance that the fence should be placed from the roadway will vary with the height and type of fence—15 ft. for each foot of height is recommended.

In some localities it will be necessary to place a snow fence on both sides of the road to obtain full protection. Otherwise, sudden storms from directions opposite to the prevailing winds may block the road.

A good snow fence should be durable; light and compact to facilitate handling, transportation and storage; easily and quickly erected and taken down, or raised to continue in service when drifted over with snow.

Results of tests with our wind tunnel on the various types of artificial snow fences may be summarized as follows:

1. Each type of snow fence produces a characteristic eddy which remains constant for any wind velocity and height and type of barrier. The distance from the fence to the end of the eddy varies with the height of fence by the ratio of 15 to 1 respectively. This is true of the horizontal and vertical-slat fence only. The solid-type fence varies by the ratio of 10 to 1. In other words, a horizontal-slat snow fence 4 feet high should be placed at least 60 feet from the travel way.
2. The size and shape of the eddy area produced by a fence will control the size and shape of the completed snowdrift. The fundamental shape of the eddy and snowdrift is in the form of an ichthyoid curve.
3. A snow fence with a ratio of 1 to 1 for the width of slats and the opening between the slats gives the best results. A barrier with 50 per cent open spaces should be the most efficient.
4. Raising the bottom of the fence more than 12 inches above the ground reduced the effectiveness of the fence at high-wind velocities. A height of 6 inches above the ground gives the best results for all conditions.
5. Any inclination of the fence from the vertical reduces the length of the eddy and the drift. However, an inclination of not more than 30 degrees with the wind tends to keep the bottom of the fence clear.
6. The position of the maximum depth varies with the type of barrier, wind velocity, and density of snow. This distance may be any length from zero (at the barrier) to two-thirds the length of the drift. The end of the drift will remain constant.

Natural Snow Fences

The natural barrier, or snow fence, consists of trees or shrubs planted in rows or groups in such a way as to slow down the normal velocity of the wind and produce a drift. This type of snow control is best adapted to wide right-of-ways and localities where permanent snow fences may be left in place the year around. The natural barrier fits in very nicely with the modern trend toward highway beautification.

It is obvious that the arrangement of the trees in the planting will affect the results produced by the barrier as a whole, but there seems to be no fixed rule for the best arrangement of trees and rows. In present practice the trees when planted vary in height from a few inches to several feet, local conditions, available stock and cost being no doubt the deciding factors. As it takes 4 to 6 years to grow a tree of effective height, many advantages are gained by planting the higher trees; for these give immediate protection and beautification with low maintenance cost, although high first cost, while the smaller trees require years of maintenance against grass, weeds, fire, theft and cutting off by machines, factors which offset their lower initial cost.

Tree planting arrangements at present being employed may be classified as single row, double row and multiple row.

1. The single-row barrier, to be effective, must be planted very close. The trees are allowed to take their

natural growth or are topped each year to form a dense hedge. This type of planting is suitable for narrow right-of-ways and spots where the more open and wider barriers cannot be used. The spacing of the trees will depend upon the maturity height of barrier, the shape of the tree to be planted, and the kind of tree.

2. The two-row barrier is used quite extensively. The trees are planted either close together in each row to form a tight barrier, or loosely and staggered to form a more open barrier. The trees are planted from three to four feet apart and thinned as they grow up, or they are spaced several feet apart and allowed to take their natural growth.

3. The multiple-row barrier may consist of 3 or more rows of trees. The usual number is 5 rows of trees. The trees are usually spaced from 8 to 10 feet apart in the rows and the rows may vary from 5 to 15 feet apart.

In the case where deciduous trees are used instead of evergreens, the tall trees are placed on the lee side of the barrier and low-growing shrubs are planted on the windward side to prevent the wind from sweeping under the trees.

In general, it may be said that the planting arrangement will depend upon:

1. The width of the right-of-way together with the length of the barrier and the topography and development of the lands adjacent to the highway.
2. The species of trees to be used and their growth, spread, hardiness, and tolerance.
3. Spacing for moisture and feeding area for the roots.
4. The age to which the belt will be allowed to grow.
5. The facilities for cultivation and maintenance between the rows and the type of machinery to be used.
6. Planting close enough to get the benefits sought and keep down the weeds and grass.

The most suitable trees are the pines, spruces, firs and cedars. Low-spreading shrubs, such as buffaloberry, buckthorn, willow, barberry and others, are used in various combinations with box elders, green ash, white elm, caragana, northwest poplar and other trees that have a suitable branch development.

The effective area of a tree barrier will extend from the edge of the trees for an average of about 16 feet for each foot of tree height; which distance is obtained by our wind tunnel tests checked by measurements in the field. A one-row barrier will have a shorter effective area than a two-row because of the openings between the tree tops, which are sealed in the two-row.

The trees should have a rapid growth of dense branches which will remain close to the ground. The yearly growth of coniferous trees may vary from 3 or 4 inches to 18 inches, depending on soil, climate, and moisture conditions. A fair average may be taken as 12 inches per year, which will cover most of the varieties. The spruces, firs and cedars are the most tolerant, that is, they can be planted in groups, or close together, without shedding their lower branches. Their foliage is quite dense, more so than the pines. The Norway spruce is considered one of the best trees because it is a fast grower, very tolerant, dense, and will do well under most conditions.

Under-planting may be necessary when the older trees become large and shed their lower branches. The opening must be filled with some species that is very tolerant and will stand shading.

To break the effect of uniformity in plantings, the rows may be irregular in number with the greater depth at points where the drifting is most serious.

Our prairie states have found it necessary to plant deciduous trees and shrubs in localities where the evergreens will not stand the severe conditions. The barrier usually consists of several rows, with the taller trees on the inside rows and the low-growing shrubs planted in the windward rows to prevent the wind from blowing under the trees.

Shrub planting for snow control.—Very little use, if any, has been made of our flowering shrubs as a source of material for snow barriers. There is no reason why they could not be used, and they certainly would work into a highway-beautification plan more readily than a long monotonous row of evergreens.

A shrub suitable for use in a snow barrier should be very hardy, have strong flexible branches to withstand high winds and snow and ice deposits, be tolerant to sun or shade, and grow under adverse soil and climatic conditions.

There are many shrubs of native and domesticated varieties that will come under these specifications. They are either tree-like in shape like the magnolia, hawthorn, and sumac, or upright like the mock orange, caragana, Japanese quince, or of the drooping type like the red dogwood, barberry, and spirea.

All planting should be harmonious and adapted to the locality and should usually be native stock. The use of native stock has three distinct advantages. First, native plants harmonize with the plant character of the surrounding country. Second, native plants are hardier under roadside conditions than are imported or developed plants. Third, native plants require less maintenance. In some cases, it is desirable to use non-native stock as an addition to the native species.

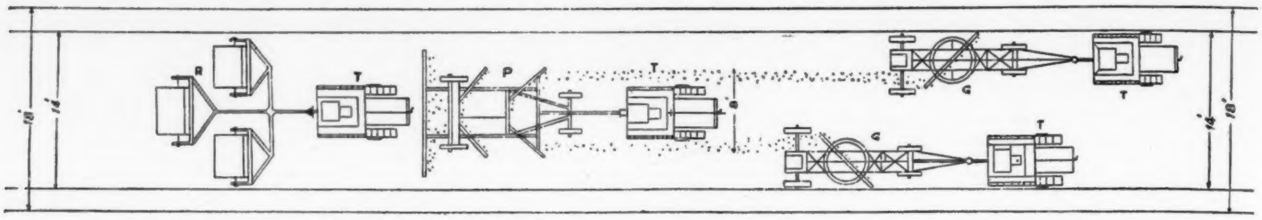
In planting, the shrubs should be selected for their winter appearance as well as summer appearance. It is possible with the varieties available to have continuous bloom from early spring to late fall, and throughout the winter there are the berries and colored barks that will blend in with the winter landscape.

The planting arrangement at each drift spot will require careful consideration. It will be necessary to consider the length of planting, thickness of the planting, height of shrubs, distance from the roadway, a solid or open planting, arrangement of the shrubs for effectiveness, and local conditions.

During the last few years roadside improvement has been given a great deal of consideration. There is no reason why a planting along the roadway cannot serve a two-fold purpose of snowdrift protection and beautification.

Bituminous Emulsions on Road Margins

Marginal strips are provided alongside the German motor roads in order to afford additional width for emergency use and for temporary stops, and to prevent the access of water to the sub-grade. A 5-in. to 8-in. foundation of broken stone (1.6 and 2.2 in.) is laid immediately beside the carriageway, and consolidated. The chippings (0.12 to 0.5 in.), which are coated with about 7 per cent. of slow-breaking bitumen emulsion, are placed in one course 1.8 in. thick if the weather is dry and hot. At other times two applications are made, one of 0.2 to 0.5 in. material to a thickness of 1.2 in., the second of 0.12 to 0.2 in. chippings to a depth of 0.8 in. The material is rolled after each application, and emulsion is spread with brooms over the finished surface at the rate of 3.7 lb./sq. yd., and covered with fine chippings. The total amount of emulsion used is about 17 to 18.5 lb./sq. yd., and that of chipping about 18.4 to 19.3 lb./sq. yd. *Road Abstracts*, Castner, *Strassenbau*, 1936, 27 (7).



T = Tractor G = Grader P = Road planer or maintainer. R = Triple set of rollers (6 tons).

Ground plan showing sequence of operations of complete unit of equipment

Earth Road Construction and Maintenance by Machinery in India

By G. L. D. BREADON

District Engineer, Gurdaspur, Punjab

This is an abstract of an article in Highways and Bridges, London, England. Rupees have a par value of about 62 cents; the present exchange value is about 38¼ cents.

THESE notes relate exclusively to earth roads, which, all Engineers will agree, must form the backbone of the road system even if India embarks on a program for extending her hard road system. *Earth roads,* under all conditions, will, for all time, remain the *people's roads,* i.e., the District Boards' Roads.

For road construction and maintenance an outfit should consist of:

Two graders fitted with scarifiers and back slopers.
Two tractors for graders.
One road planer, or smoothing drag, or so-called "Maintainer."
One tractor for road planer.
One triple set of road rollers (6 tons).
One tractor for rollers.
One motor lorry for transport.
Four tents for operators and coolies.

The plan attached shows the sequence of operations in which a complete outfit should proceed along the road.

The advantages that this system offers are threefold.

Firstly.—About 10 miles of maintenance work, including drain - excavation, surface cutting, surface-forming and consolidation, can be executed in a working day of eight hours; that is 60 miles of road can be improved weekly, without the operators being inconvenienced, as a lorry enables them to change camp daily.

Secondly.—It is the most economical method of road maintenance and road construction. The cost of improvement by manual labor is about Rs. 1,500 a mile and subsequent maintenance varies between Rs. 200 and Rs. 350 a mile, whereas with a mechanical outfit, including all working charges and depreciation, improvement costs approximately Rs. 60 per mile and maintenance from Rs. 20 to Rs. 40 per mile, according to the nature of work and season in which it is executed.

Thirdly.—The whole outfit operates simultaneously; a grader works on each side of the road cutting a side drain, sloping the edge of the road and conveying the loose earth on to the road; the planer or drag following spreads the earth evenly over a width of 9 ft. along the road surface, and at the same time cuts down and smooths over all irregularities in the road; while the rollers in their turn consolidate the earth leaving behind them a finished road ready for immediate use.

Referring to the attached plan given above, when the existing side drains of a pre-graded road are in a fairly serviceable condition it is not necessary for more than one grader cut to be made on each side of the road, in order to provide sufficient earth for the making up of the road surface. The width of the road is determined by the spread of the blades of the maintainer, which in the case of McCormick-Deering No. 61 planer, is 9 ft. The mounds of earth left by the grader should, therefore, not exceed 8 ft. from outside to outside. When spread over the surface of the road by the long movable blade behind, the width is increased to about 10 ft. which is easily covered by the rollers. Should a larger quantity of earth be required for the roadway, and it be also desirable to widen and deepen the side drains, the graders will have to make two cuts on each side of the road, the first cuts being 18 ft. apart and done independently of the maintainer and rollers. These will not come into operation until the graders are making their second cut, which will be in parallel lines 14 ft. apart.

It is very important, not only for the sake of appearance, that the first cut made by the grader should be straight, as all succeeding cuts are governed by the first, and any irregularity which appears in the first cut is likely to persist in the finished ditch. It is even more important when a maintainer is in use that the guide lines for the grader should be accurately laid out and be parallel.

Cost of Operating the Outfit

For the purpose of checking the cost of grading I give below the average consumption of oil, lubricating oil, etc., also cost of labor and depreciation on an outfit consisting of one T. 20 Trac-Tractor and one Adams leaning wheel grader:

(1) Kerosene oil=0.93 gallons per mile travelled.
(2) Lubricating oil=0.08 gallons per mile travelled.
(3) Petrol=0.02 gallons per mile travelled.
(4) Grease=0.02 pounds per mile travelled.
(5) Thick lubricating oil=0.007 gallons per mile travelled.
(6) Miscellaneous (Lime, soap, cotton waste, etc.)=0-4-3 per mile travelled.
(7) Establishment=1-1-8 per mile travelled.
(8) Depreciation=1-6-8 per mile travelled.

The cost (not including repairs and depreciation) should ordinarily not exceed Rs. 2-8-0 per mile travelled. The total cost including repairs and depreciation for the year 1933-34 worked out to Rs. 4-0-9 per mile travelled.

During five months of the current year the cost of working an outfit consisting of a T 20 Trac-Tractor, a 22-36 McCormick-Deering wheel tractor, an Adams leaning wheel grader, a Stockland grader, a 61 maintainer and a set of triple rollers (6 tons) is:

Kerosene oil=1⅛ gallons per mile travelled.
Petrol=1 gallon per 50 miles travelled.
Mobile Oil=1 gallon per 12 miles travelled.
Gear Oil=1 gallon per 35 miles travelled.
Grease=1 pound per 16 miles travelled.
Miscellaneous (cotton waste cleaning cloth, soap, etc.)
Establishment, Rs. 0-13-6 per mile travelled.
Depreciation, Rs. 3 per mile travelled.
Lime for marking road.

The estimated cost including all charges is Rs. 5 per mile travelled.

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61

Establishment.—Establishment employed on working the above machines consists of:

	Rs. p.m.
1 Tractor-driver mechanic	70
1 Tractor-driver	42
2 Grader operators at Rs. 40 each	80
1 Jemadar	20
8 Khalasis at Rs. 15 each	120
2 Cartmen at Rs. 40 each	80
Total	412

I would, however, like to have a mechanical overseer with road experience to supervise the work, paying him Rs. 100 p.m., which would be more than covered by the additional work which could be done if the tractor-driver were relieved of setting out the work and general supervision.

Manual Labor.—Despite the fact that a grader can conveniently raise a road to a height of 2 ft., provided that sufficient land is available on both sides of the roadway, from which soil can be cut and conveyed to the bank, we cannot entirely dispense with coolie labor in the construction, improvement and maintenance of earth roads. Manual labor is necessary for (*a*) repairing bridges and culverts and in keeping their approaches in order: (*b*) closing breaches in roads and in raising such portions of the road where machines cannot operate; (*c*) clay covering sandy stretches; (*d*) grubbing out stumps and roots of trees; removing jungle and large rocks; (*e*) cutting outlets from drains; and (*f*) keeping road crossings in proper order.

Cost of Incinerating Rubbish and Garbage

The town engineer of an eastern New York municipality asks us for any data available concerning cost of incinerating rubbish and garbage in small towns and villages. Our reply is as follows:

The smaller the town, the less reliable are the figures for incineration cost. Therefore, the data that we are giving you must be taken for what they are—good indications of what it will be likely to cost. Some of these cost figures include cost of interest and depreciation, also. That, too, is difficult to pin down, because in some plants the initial costs have included a large amount for land, and a considerable sum for a ramp to the feeding or charging platform. When the site is already village property, or a costly ramp is not needed, the initial cost may be but half as great.

Not all of these figures are for small communities, but they are the best we have.

Fredericksburg, Va.: 34 cents a ton for incineration alone; probably includes only the actual operation costs.

Other Virginia cities: Costs vary from 66 cents a ton to $1.43 per ton, including collection; probably not depreciation and interest.

Sharon, Pa.: Cost $1.08 per ton; interest and depreciation 87c per ton; total reported cost $1.95 per ton.

Racine, Wisc.: Costs, 85c in 1932; $1.05 in 1931; $1.02 in 1930. Believe this includes interest and depreciation.

Winston-Salem, N. C.: 50.4c in 1933; 64.6c in 1932. Probably does not include interest and depreciation.

St. Petersburg, Fla.: About 70c per ton for operation.

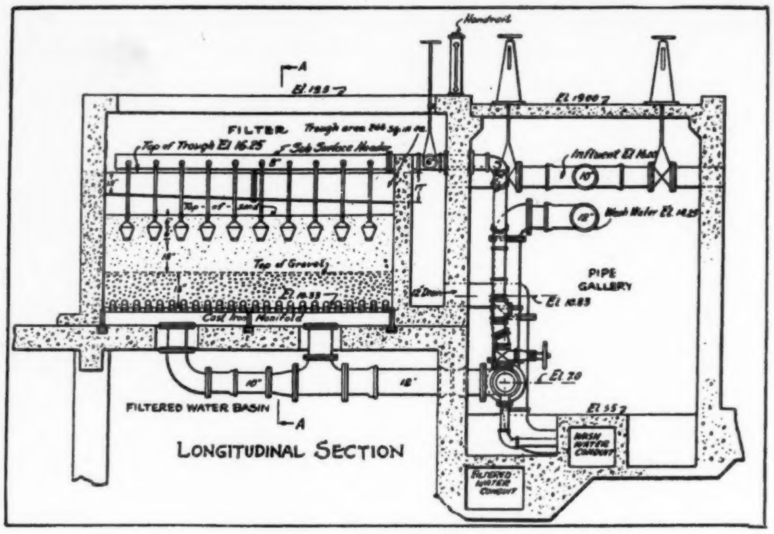
Miami, Fla.: 76c per ton for operation; 81 cents per ton for interest and depreciation.

Greenwich, Conn.: Metcalf & Eddy estimated a total cost for incineration of $1.71 per ton.

Our general information for the northern part of the country and for small communities is that the cost for incineration alone will run from 75 cents a ton to $1.25 or $1.35; and that interest and depreciation will ordinarily add 80 or 90 cents a ton to this. It depends somewhat, as stated above, on ground costs and conditions at the site.

The Water Wheel

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.



Section of a sub-surface filter

Subsurface filtration has been in operation in one of the two 0.5 mgd filter units at Kenilworth, Ill., for over two years, and is to be applied to the other one also. In this system, in addition to the customary bottom washwater grid, there are 110 lantern-shaped screens placed about 15″ apart both ways 6″ below the surface of the 30″ sand bed and connected to the influent system. The water to be filtered is applied at the surface in the usual way and also through these subsurface screens; being removed through the bottom strainers. Floc therefore is caught not only on the surface but also around each screen. The combined surface areas of the subsurface screens is about 50% that of the sand bed, and this filter is run at a rate of 50% higher than the filter not having subsurface screens—100% under favorable conditions. In washing the filter, wash water enters through the subsurface strainers as well as the bottom ones, about 70 to 80% through the former, and better agitation and scouring are obtained with only 20 to 25% expansion than in ordinary practice, ridding the filter of mud balls. The subsurface screens are truncated cones of woven stainless steel wire set with the axis vertical and small end down. As the water always passes out through them, they do not clog with sand.[G25]

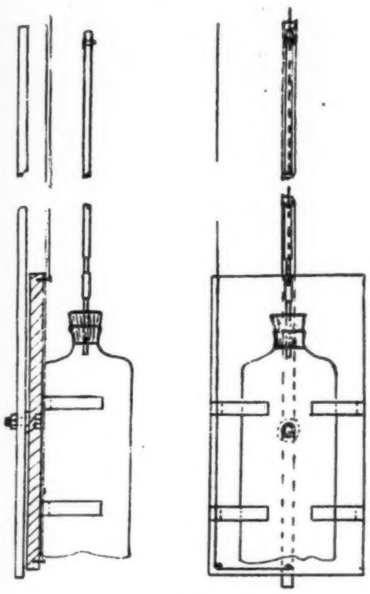
Multiple-arch reservoir wall, perforated wall inlets and outlets to settling basin, and power derived by turbine from raw water supply are interesting features of the new filter plant at Fort Smith, Ark. The storage reservoir, approximately 100 ft. diameter and 20 ft. water depth, is enclosed by twelve arches springing from cantilever buttresses, the heel slabs of which form part of the reservoir bottom. The arch walls, 8″ thick, and buttresses 20″-32½″ thick, are of reinforced concrete. A slip joint between arch and footing permits full arch action. Water enters the settling basins through 8x8 in. square openings in the wall of the influent flume which is built across the entire end of both basins, to provide uniform distribution of flow, and leaves through a similarly perforated wall at the opposite end. The water is brought from a mountain reservoir, the elevation of which permits creation of hydraulic power by connecting a turbine to the pipe line, which operates a 10 kw generator and also the pump which raises water to the washwater tank 50 ft. above the filter. The entire plant is operated by this power. An emergency 50 hp oil engine driving a 30 kw generator is provided. The 200,000 gal. concrete washwater tank is of hoop tension design.[E42]

The orthotolidine test for residual chlorine is influenced by many factors, the effects of which must be guarded against or allowed for. The orthotolidine solution should not be added to sample until 10 minutes after the chlorine is applied. Examination of color should be made in 3 to 5 minutes; but with chlorine-ammonia treatment, if the pH is above 8 and ammonia dose exceeds 1/3 the chlorine dose, a reaction period of 10 to 15 minutes should be used. The water tested should have a temperature of at least 60° to 68° F., being warmed if necessary. Water of high alkalinity requires use of a more acid orthotolidine solution than heretofore specified (the 1936 "Standard Methods" will cover this). The reagents and color solutions should be stored in the dark; the test should not be made in direct sunlight, but with diffused daylight or (at night) with "daylight" lamp. Use method to compensate for any natural color or turbidity of the chlorinated water. Errors due to nitrites should be anticipated when testing effluent of filter plants pretreated with chlorine and ammonia, or chlorine alone in the case of swimming pools; concentrations of nitrites greater than 0.03 are likely to cause serious errors; neither the hydrogen peroxide nor any other known modification of the test will compensate for errors due to nitrites, and the neutral starch-iodide test is recommended for such cases—also if oxidized or ferric iron is present in concentrations greater than 1.0 ppm, or oxidized manganese in concentrations exceeding 0.01 ppm. The 1936 edition of standard methods will contain a modified test for eliminating such errors.[A85]

Watershed control against pollution seems to be very strict in British Columbia, any trespass on waterworks land without written consent of the water commissioner being punishable by fine up to $50. On the 41.2 square miles of watershed area owned by Victoria, no one is allowed to enter without obtaining a permit, which involves explaining to the water commissioner why he wishes to go, and then to the city medical health officer whether he has ever suffered from typhoid, paratyphoid fever, cholera or dysentery; then going to a hospital for a blood test to show that the blood does not react to typhoid fever by the Widal test, when the health officer

furnishes cerificates that the applicant "is free from any communicable disease," and "has given a negative Widal reaction." If these are satisfactory to the water commissioner, the city council must approve before he can sign the permit.[A84]

Flocculated water samples are obtainable at any depth without breaking flocs by agitation by means of a depth sampler designed by G. M. Darby, A 1-liter bottle from which the bottom has been cut is fastened to a board, which board is so fastened to the lower end of a rod that it can revolve around its center. A cord is fastened to the bottom of the board so that, when pulled, the board will turn bottom end up. A rubber tube is fastened in the mouth of the bottle and extends above the surface of the water in the basin to be sampled. Then, with the open end of the bottle down and the tube clipped shut, the bottle is lowered to the desired depth, the clip removed from the tube so that the bottle fills slowly as the air escapes; then the bottle is inverted by pulling the string and lifted to the surface.[G22]



Water Works & Sewerage

For taking depth samples of flocculated water

Plant operation accounting in many offices makes staff members and employees its victims and slaves; they should be its masters. A proper system should include: 1—Simplicity, without sacrificing quality. 2—Brevity, without sacrificing desired results. 3—Illuminating, giving needed information understandably. 4—Accuracy, dependable and authentic. 5—Availability, should be inspected regularly by all the staff. 6—Economy; profits accruing should justify the cost. 7—Adequacy, including all important items of operation. 8—Use original records or tie into and refer to records of original entry. The records should be inspected and initialed each day by the management and returned to the operators for their inspection of comments noted thereon before they are posted and filed.[A73]

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c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Association*
August

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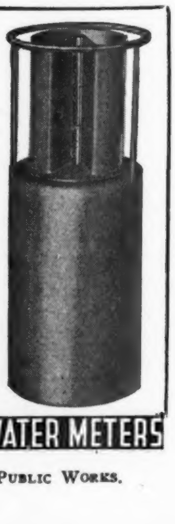
77. PWA Water Projects in Illinois. By C. H. Bauer, pp. 1022-1031.
78. The WPA and Water Works Opportunities. By A. H. Myers, pp. 1032-1037.
79. Physiological Effects of Mineral Salts in Natural Waters. By C. B. Pollard, pp. 1038-1043.
80. Water Quality Deterioration in Distribution Systems. By N. J. Howard, pp. 1044-1050.
81. Reforestation and Water Resources. By A. H. Richardson, pp. 1051-1061.

When writing, we will appreciate your mentioning PUBLIC WORKS.



82. Fluorides in the Natural Waters of Rhode Island. By W. G. Parks, M. Robinson and M. Law, pp. 1064-1067.
83. National Water Policy. Report of Committee, pp. 1068-1074.
84. Watershed Protection and Control. By G. M. Irwin, pp. 1075-1089.
85. Recent Advances in the Control of Chlorination. By C. R. Cox, pp. 1090-1096.
86. Economies Effected by Constructive Planning. By E. K. Wilson, pp. 1097-1102.
87. Is Your Water Supply Adequate for Fire Protection Purposes? By J. B. Wilkinson, pp. 1103-1109.
88. Is Your Water Supply Adequate for Domestic and Industrial Purposes? By J. Donohue, pp. 1110-1116.
89. Grand River Water Supply and Flood Prevention. By F. P. Adams, pp. 1117-1121.
90. Typhoid Fever in the Large Cities of the United States in 1935, pp. 1122-1133.

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19. Water Resources and Supplies in England and Wales, p. 181.

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39. Hydraulic Valve Operation Controlled by Small Motor-Driven Pumps. By H. Vagtborg, pp. 335-336.

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40. Detroit Tunes Up Its Springwells Pumping Plant. By B. J. Mullen, pp. 393-396.
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42. Filter Plant for Fort Smith Treats New Mountain Supply, pp. 400-402.
43. Long-Delayed Filtration Plant Completed at Fort Scott, Kans. By F. D. Martin, p. 403.

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61. New Water Works of Fort Smith, Ark. By C. F. Byrns, pp. 1068-1073.
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71. Zeolite Method of Softening. By C. R. Cox, pp. 1147-1148.
72. Testing Mains Before Trench Is Backfilled. Round Table Discussion, pp. 1163-1164.

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23. *p.* Experiences With Automatic Control Equipment at Pumping Plants. By H. A. Harris, Jr., pp. 269-273.
24. Scale and Corrosion Control in Aqueous Systems. By D. W. Haering, pp. 275-278.
25. *p.* Subsurface Filtration at Kenilworth, Ill. By C. C. Ley, pp. 293-296.

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16. Monthly Billing of Water Accounts. By J. A. Lindop, p. 66.
17. Thawing Frozen Water Lines. By A. D. Claggette, pp. 69-70.
18. Electric and Diesel Power for Deep-Well Pumping. By M. Vrooman, Jr., pp. 71-72.
19. New Gravity Water Supply for Big Stone Gap, Va. By W. M. Johnson, pp. 75-76.

K *Proceedings, American Society of Civil Engineers*
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5. Selection of Materials for Rolled-Fill Earth Dams. By C. H. Lee, pp. 1025-1042.

M *Canadian Engineer*
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35. A Pitometer Waste Survey in Lachine, Que. By R. Dorion, pp. 7-10.
36. *p.* Safe Limit of Pollution in Raw Water Supplies. By H. W. Streeter, pp. 11-12.
37. Water Works Accounting System at London, Ont. By C. Jacques, p. 13.
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40. *p.* Water Works Problems of a Small Municipality. By W. G. Breen, pp. 7-9.

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25. The Water Resources of New England, pp. 9-12.
26. Freezing Troubles in Indiana Municipalities, p. 12.
27. Distribution System Survey Profitable for Winchester. By A. M. Field, pp. 17-18.
28. Design and Construction of a Small Earth Dam for Water Supply, pp. 23-24.

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3. 48-Inch C. I. Pipe for Bayonne Water Transmission, pp. 42, 43, 52.

W *Johnson National Drillers Journal*
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4. Conservation of Ground Waters of the Roswell Basin. By T. M. McClure, pp. 1-7, 11.
5. Testing the Yield of Wells With Air Lift, pp. 12-14.

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

The Digestion Tank

Ferric chloride as coagulant in small doses neither renders insoluble, nor oxidizes nor inhibits oxidation of *soluble* sewage substances, either alone or in conjunction with high lime dosages; but there is sometimes a definite delay of biological oxidation when reaction control with sulphuric acid is followed by $FeCl_3$ and large quantities of iron coagulant. The rate of oxidation of colloidal and soluble organic substances is similar, although the ratio of oxidation of the soluble is somewhat slower than that of the colloidal. After 5 days incubation the soluble and colloidal is nearly completely oxidized, whereas the coarser substances continue to undergo oxidation. Reduction of BOD of soluble and colloidal substances by $FeCl_3$ is not due to toxicity of the coagulant but to a removal or fixation of the organic materials.

To obtain best results, either with or without lime, rapid initial mixing during addition of the chemicals is essential. The flocculation time required is dependent upon the coagulant dosage and to some degree upon the type of sewage. With proper mixing, optimum chemical dosage and slow flocculation, complete coagulation can be accomplished in from 15 to 30 minutes; there is no danger of reduction of ferric salts to the ferrous condition, so aeration is not necessary to prevent this. With dosages of coagulant sufficient to produce nearly complete clarification, diffused air flocculation was more rapid than paddle, but with smaller dosages little difference was observed between the horizontal paddle-type flocculator operated at either slow or rapid speeds and aeration; in general, air flocculation was inferior. At equal speeds of flocculation the horizontal paddle type produced better results than the propeller type of flocculator. Flocculating speeds much higher than normally used were found to give better subsequent clarification. With higher speeds, no scum formation occurred with the swirling propeller type of flocculator, grease was embedded and the floc was not disintegrated. The concentration of settleable solids was not a factor in determining the time or speed of flocculation.[C27]

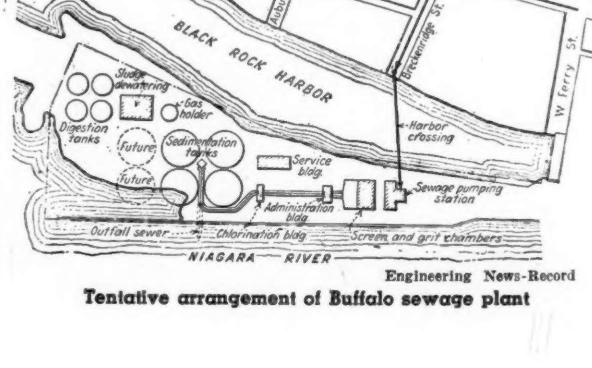
Ferric salts used in sewage treatment vary in effectiveness, availability and sources of supply, cost, and requirements for storage and feeding. In planning or designing a sewage installation, these considerations should be studied in selecting the salt to be used, and handling and feeding devices provided to accommodate the particular chemical or chemicals decided upon. The only practical basis for cost computation is the assumption (apparently justified) that one pound of ferric iron as chloride, sulfate or chlorinated copperas is equally effective for sewage treatment. In sludge conditioning, however, the author found 1 part of ferric iron as chloride equals 1.15 as chlorinated copperas and 1.33 as ferric sulfate. The cost per 100 lb. of ferric iron has varied from \$3.75 to \$10.30 per mg of sewage treated; and the cost for sludge conditioning with 1% dosage, from \$0.95 to \$2.08 per ton of dry solids. In determining the cost of 100 lb. of chlorinated copperas, that of 189 lb. of chlorine must be added to that of 100 lb. of iron. To make chlorinated iron at equal cost the chlorine must cost less than 3 cts. a pound.

Ferric chloride in solution costs less than as crystals, but railroad sidings and liquid handling and storage must be provided. For chlorinated copperas, chlorinating equipment must be furnished. The cheaper grades of copperas are more apt to cake in storage and cannot be fed with dry feeders. Purchase of chlorine in bulk, with storage facilities for same, may lower its cost as much as 50%.[G18]

Aeration power units commonly used in writing aerator specifications and reporting power consumption in activated sludge plants are "hp per mgd" or "kwh per mg." These do not take into consideration concentration or strength of sewage treated. An aeration power unit should be based on aeration performed and Wisely and Klassen suggest as a unit "kwh per pound B.O.D. removed."[E19]

Gas liquors in sewage up to 1.0% "can be treated on biological filters at a uniform rate of 70 gallons per cu. yd. per 24 hours, with a reduction of phenol content of from 60 to 70% and a reduction of the oxygen absorbed figure of from 40 to 50%"; but concentrations of more than 1.0% are "definitely harmful." This is the conclusion from experiments by the West Riding of Yorkshire Rivers Board. The main oxygen-absorbing constituents of gas liquors are phenols and pretreatment that does not remove these is of little value. At one gas works the gas liquor, about 1,000 gpd, is passed upward through a filter of wood wool 2' 6" diameter and 3' 6" high held between a top and bottom disc, the latter 6" above the bottom of the tank; the intercepted tar is drawn off periodically.[D39]

Buffalo, N. Y., treatment plant plans are ready for letting contracts this fall. They include a main pumping station, trash rack, grit chambers, large aerated conduits, plain sedimentation tanks, and mechanical devices for dewatering and incinerating sludge. As an alternative the sludge may first be digested and then dewatered, then either incinerated, used as fertilizer or deposited in dry fill. Screenings mechanically removed from bars with ¾" clear opening will be



Engineering News-Record

Tentative arrangement of Buffalo sewage plant

Dollars-and-Cents

OF COLD-WEATHER CONCRETING

Low temperatures and long-standing habit usually bring winter construction almost to a standstill. This persistent tendency to "wait until Spring" means retarded recovery and reduced employment, precisely when it is needed most. Maybe cold-weather delays were necessary, when low temperatures meant extended freezing hazards, increased concreting costs and slowed construction progress. But the old picture has been radically changed by 'Incor', the improved Portland Cement which cures or hardens in one-fifth the usual time—with these significant results:

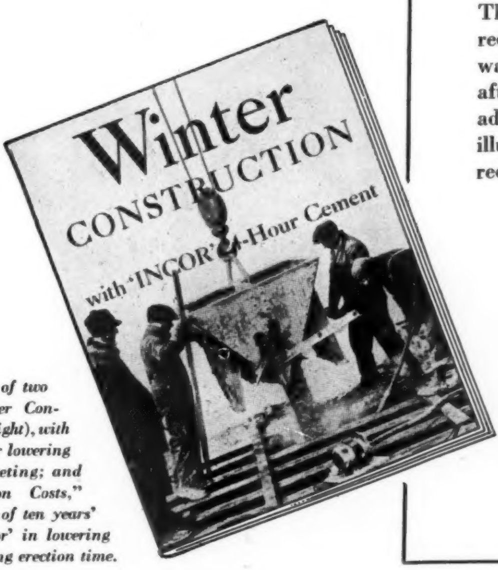
60 to 70 per cent saving

A 60 to 70 per cent reduction in the cost of heating and protecting concrete against low temperatures (see typical saving, below); faster re-use of forms—one set with 'Incor' does the work of two or three with ordinary cement; summer erection schedules in dead of winter; and steadier construction progress—which means that the time men used to waste idling around a fire is turned into wages.

These advantages, realized through 'Incor's dependable high early strength, make year-around building—talked about for a generation—a thoroughly practical reality.

Two illustrated books give full details. One, entitled "Winter Construction" (shown below), gives simple concreting precautions needed in cool, cold and sub-freezing weather; tells how 'Incor'* reduces costs, makes summer schedules possible in winter months. The other book, "Cutting Construction Costs," deals in a simple, practical way with the cost factors in concrete-frame erection, giving suggestions for concreting economies. For free copies, address Lone Star Cement Corporation (subsidiary of International Cement Corporation), Room 2208, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.



Write for free copies of two timely books: "Winter Construction" (shown at right), with helpful suggestions for lowering cost of Winter concreting; and "Cutting Construction Costs," presenting the results of ten years' experience with 'Incor' in lowering form costs and reducing erection time.

TYPICAL WINTER SAVINGS WITH 'INCOR'

The quicker concrete hardens, the less time and expense are required to provide heat. With 'Incor', you simply heat mixing water and aggregates and provide heat-protection for 24 hours after concrete is placed. With ordinary cement, at least two additional days' heat-curing are necessary. Following example illustrates heat-protection savings—one of several ways 'Incor' reduces costs:

6-story concrete frame—100'x100'
30 salamanders required to provide heat per floor.

Operating Costs:

Coke, 5 tons a day, at $8	$40 per day
Labor, 4 men tending fires, at $5	20 per day
Heat Cost	$60 per day

'Incor' Saves:

2 days' heating expense per floor	$120
For 6 stories and roof	840

These savings in fuel and labor are usually accompanied by substantial form savings and reduction in erection time, which means reduced overhead costs as well.

'INCOR' 24-HOUR CEMENT

ground and returned to the sewage. Grit will be mechanically collected, elevated and washed and delivered into bins. The conduits, 9′ wide with 8′ sewage depth, will not always have velocity sufficient to prevent deposits and air agitation will prevent deposits and drive off entrained gases, using perforated pipes. The air from all conduits up to the sedimentation tanks will be delivered to a ventilating tower or some other place, with provision for air cleaning as by scrubbing, burning at high temperature or chlorinating, or pumping into the river.[E21]

A sewage farm of 1,400 acres area receives the crude sewage of 304,500 inhabitants of Nottingham, England, but new works were expected to go into operation in September. These contain detritus chambers, coarse screens, fine screens, and settlement tanks of 10 mg total capacity. The effluent goes to the present farm. The sludge will be pumped through a mile of 14-in. pipe to 150 acres of underdrained land, divided into 2-acre beds, where it will be plowed under when dried. Screenings will be macerated, the pulp being washed into the settlement tanks.[D38]

Comminutors in service at eight sewage plants are reported on by their operators. Most say that the comminuted matter aids the sedimentation of the finer solids, and that there is no increase in scum. In one case, where there is much grit in the sewage, the lower cutters in the commutors are sharpened about once every three months; generally sharpening $\frac{1}{3}$ of the cutters once in 2 yrs. suffices. One treating 800,000 gpd reports cost of operation $75 a year; another reports $40 for 250,000 gpd. Normal operation requires 0.2 to 1.5 hp, depending on size.[H25]

Measuring sewage flow at treatment plants is very important. Cheapest and simplest device therefor is a weir, but a great disadvantage is that solids become stranded on the weir. Venturi tubes are applicable where the sewage flows through a conduit or pipe under pressure. The Parshall venturi flume is in use at a few plants. Dosing tanks can be used as measuring devices, a Veeder or similar counter, fastened on the side of the tank and connected to a float, recording the number of times the tank discharges per day. Activated sludge can be measured by a venturi tube; also sludge from settling tanks and digester, but these usually contain 5 to 10% solids which clog piezometer rings on the meter tube and give trouble. Air can be measured by an orifice-type or a venturi meter; so also can the sludge gas, but rotary type displacement meters are more commonly used. Equipment is being introduced for weighing sludge that has been dewatered on vacuum filters as it is carried away on a belt conveyor. The methane content of sludge digestion gas is recorded at the Baltimore sewage works.[H29]

Inspection of sewers in Los Angeles has involved some new ideas. The north outfall sewer is 10.5 ft. high and 12.25 ft. wide, semi-elliptical, of unreinforced concrete lined with vitrified clay plates. Inspection to locate cracks and other possible damage in a 6-mile stretch was made last July, using a non-sinkable boat built for the purpose, in which no metal was exposed, for fear its contact with the masonry might produce sparks and explode inflammable gases in the sewer. Since it received sewage from 55 miles of branches, the sewage is stale and large amounts of hydrogen sulphide gas, gasoline vapors, etc., were present. The inspector wore

an oxygen helmet, carried an earth induction telephone for dictating notes of sewer conditions to a stenographer above ground, an electric searchlight and camera for photographing special conditions of sewer wall. The boat floated down the sewer at the end of a steel cable, between openings about 1,000 ft. apart, usually between 6 A.M. and 10 A.M. when the lowest stage of flow occurred.[E20]

Cast iron siphons are laid in an intercepting sewer at Annapolis, Md., in crossing two navigable creeks. One consists of three parallel lines of 14″, 18″ and 20″ pipe, supported on timber bents on a double row of piles. The other, laid in September, is in a force main and consists of a single line of 24″ pipe. For both siphons, super de Lavaud c.i. pipe lined with bitumastic enamel and with U. S. joints was used. In laying in the subaqueous trench, two 18′ lengths were joined on a barge, lowered by derrick onto the timber bents and connected by diver to that previously laid using the mechanical joint. The line is prevented from floating by means of iron straps covering each pipe and bolted to the bent. At the channel the grade of the pipe drops, using two 1/32 bends.[Q1]

Bibliography of Recent Sewerage Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

D *The Surveyor*
August 14
37. Swansea Main Drainage Sewers, pp. 191-192.
38. Nottingham's New Sewage Disposal Works. By T. O. Pickering, p. 193.
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39. Purification and Disposal of Gas Liquors, pp. 287-288.
40. *p*. Sewage Disposal in Rural Areas. By W. W. Baum, pp. 291-292.

E *Engineering News-Record*
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18. Clean Streams for Wisconsin, pp. 310-311.
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19. Aeration Power Unit Measures Sewage Plant Efficiency. By W. H. Wiseley and C. W. Klassen, pp. 368-369.
20. Six-Mile Trip by Boat Through Los Angeles Outfall Sewer, pp. 379-380.
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21. Buffalo Solves Its Sewage Problem, pp. 438-441.
22. Improved Sewerage System and Disposal Plant at El Paso. By H. G. Stacy and F. M. Veatch, pp. 442-445.
23. Air Conditioning Waste Water Overloads Lincoln Sewers, p. 450.

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20. Improved Method for Determination of Sulfides. By R. Pomeroy, pp. 279-281.
21. Chemical or Biological Sewage Treatment. By H. Bach, pp. 287-288.
22. *p*. Comments on Chemical Treatment of Sewages. By W. Gavett, pp. 289-291.
23. Eliminating Sewer Stoppages at Los Angeles. By C. A. Geibel, p. 292.
24. New Sewerage Treatment Plant for Harlan, Ia. By J. C. Reynolds, pp. 301-304.
25. Unique Control of Chemical Dosage and Sludge Filtration, p. 305.

H *Municipal Sanitation*
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29. Metering and Gauging of Sewage Works Operation. By C. E. Keefer, pp. 304-307.
30. Uses of Rubber in Chemical Treatment of Sewage. By H. H. Harkins, pp. 308-310.
31. Efficiencies and Economics of Effluent Filters. By S. I. Zack, pp. 311-313.
32. Laboratory Control of Sewage Treatment. By F. W. Gilcreas, pp. 314-316.
33. Sewage and Industrial Wastes Disposal in Montana. By H. B. Foote, pp. 322, 328.

J *American City*
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7. Culpeper's New Sewage Treatment Plant. By V. von Gemmingen, pp. 67-68.
8. *n*. Handling Storm Water During High River Stages in Belzoni, Miss., p. 72.

P *Public Works*
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30. The Operation of Trickling Filters. By W. W. Towne, pp. 15-16.
31. *n*. Using Settled Sewage to Wash Down Sludge, p. 16.
32. *n*. Keeping Sewage Fresh, p. 19.
33. Gadsden's New Cast Iron Outfall Sewer. By T. Watford, pp. 25-26.
34. *n*. Costs of Sewage Treatment, p. 26.
35. *p*. Cost Accounting for Sewage Plants, pp. 33-34.

Q *The U. S. Piper*
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1. Super de Lavaud Pipe for Sanitary Sewer Siphon at Annapolis, pp. 37-40.

T *Technique Sanitaire et Municipale*
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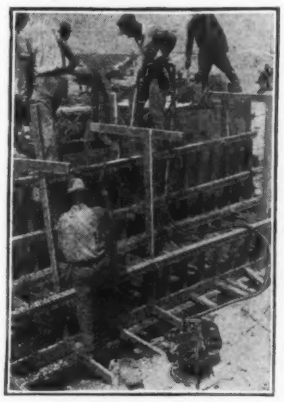
2. L'épuration collective des eaux usées des communes rurales. By A. Girard, pp. 155-158.



Placing concrete on thin wall sections with a 3 H.P. gas engine unit.

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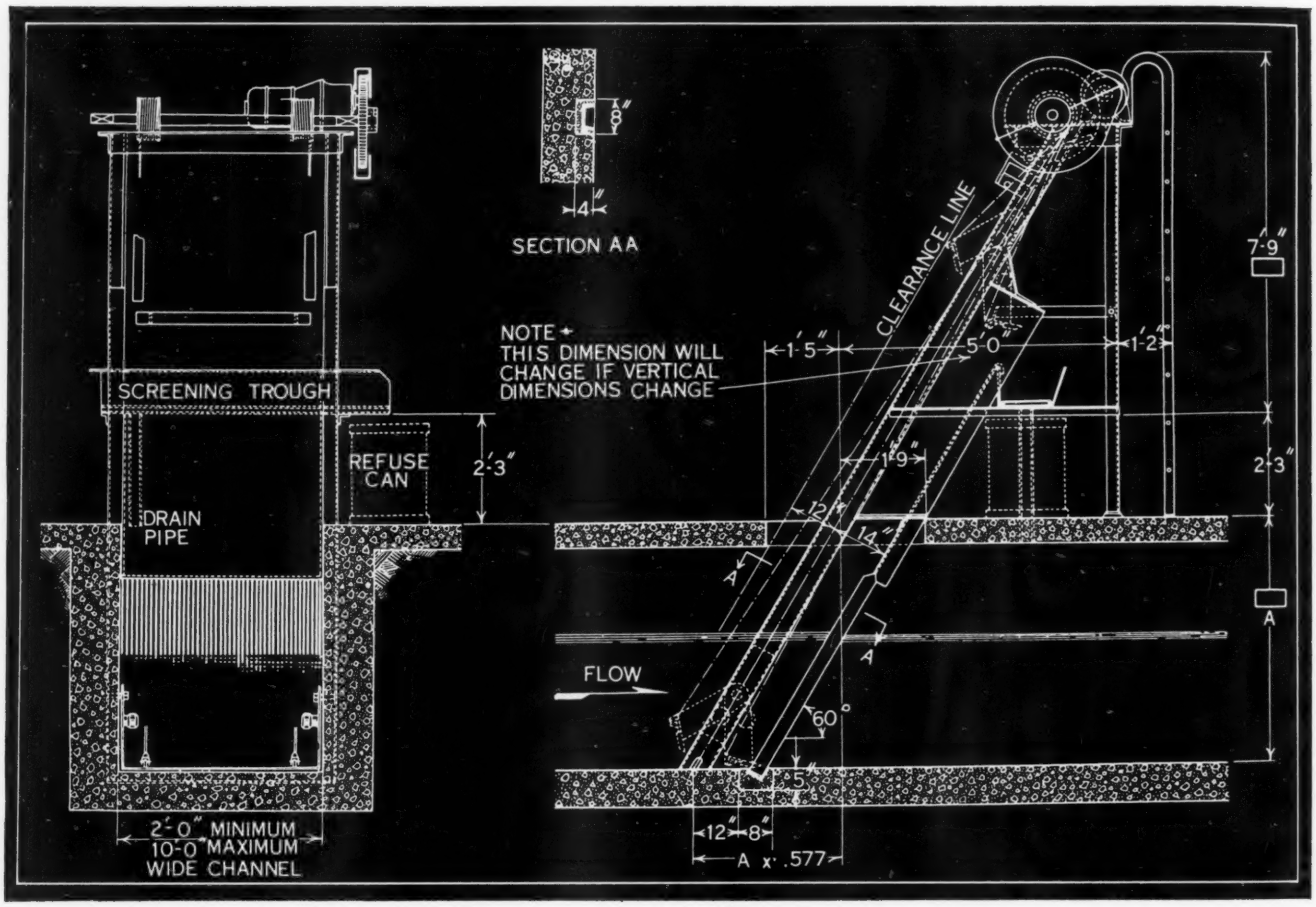

Inclined type Link-Belt Straightline Bar Screen. Also made in vertical type.

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The modern method of removing large suspended solids and debris from incoming sewage at both large and small plants.

All of our experience with sewage screening work, since the installation of the first Link-Belt mechanical screen in 1915, is built into the design of this unit. Its rugged, simple construction and special provisions for the avoidance of jamming assure dependable, uninterrupted operation under the most extreme conditions of service.

The mechanism for raising and lowering the rake that cleans the screen is similar to that used for raising and lowering the bucket on the skip hoist, the most reliable machine known for elevating materials. It is impossible for the rake to become jammed at the bottom, when encountering pieces of wood or other larger objects.

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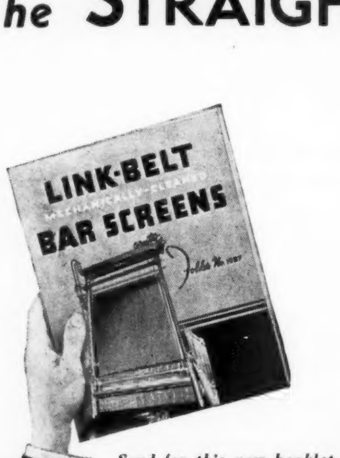

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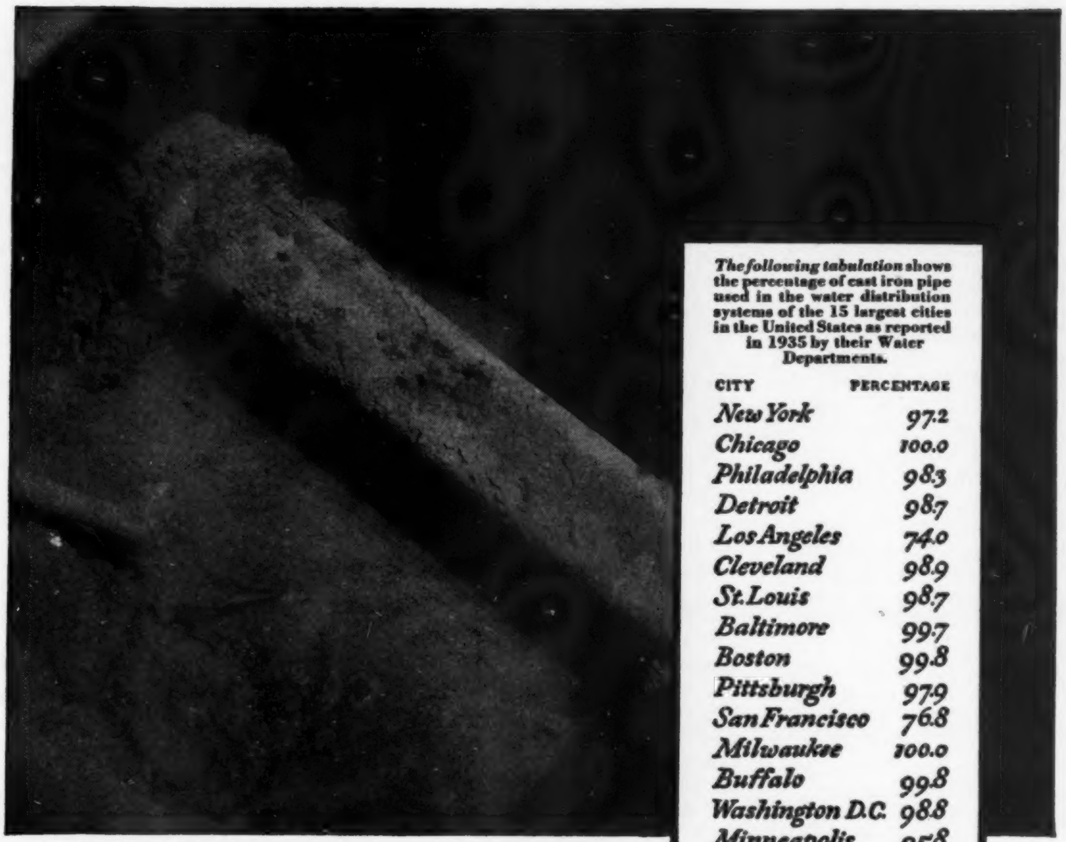


The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

Unretouched photograph of a section of 106-year-old cast iron water main still rendering satisfactory service in Philadelphia's distribution system.

WATER is free if you go and get it. But if you want it at the turn of a faucet you must pay for the service. Less than the price of a soda for a hundred gallons—a very small cost for an efficient and indispensable public service. One of the reasons why water is cheap is the long life and negligible maintenance cost of cast iron water distribution mains. More than 95% of the pipe which distributes water to the 24 million residents of our 15 largest cities is cast iron pipe.

Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

Don't forget the READERS' SERVICE DEPT.—pages 59-61

New England Water Works Association Convention

EVERY few years the New England Water Works Association holds its annual convention outside of New England, in recognition of the fact that 34 percent of its membership lives outside those boundaries, in 21 States and 8 foreign countries (12½ per cent in New York). This year, Sept. 22 to 25, it was held in New York City. More than seven hundred members and guests registered; the meetings were well attended; sixty-four exhibits, well arranged and accessibly adjoining the assembly room, showed the latest appliances and materials offered for use by water utilities; the papers were generally excellent and brought out a gratifying amount of discussion.

The officers elected for the coming year were: President, Harry U. Fuller; vice-presidents, Warren J. Scott and George A. Sampson; directors, Percy A. Shaw, H. K. Barrows and Francis H. Kingsbury. Frank J. Gifford continues as secretary and Gordon M. Fair as editor of the Journal. Past presidents Howard M. King and Roger W. Estey are members of the executive committee.

Thaddeus Merriam was made an honorary member (being the fourteenth so honored by the society), presentation being made by Frank E. Winsor, who received the same honor last year. The Dexter Brackett Memorial Medal was presented to Elwood L. Bean for his paper on "Providence Water Treatment."

Among the outstanding features of the technical sessions were a symposium of eight papers on the public health aspects and hydrology of the 1936 floods in Northeastern United States; and an address by Harold J. F. Gourley, past president of the Institution of Water Engineers (Great Britain) on "Some Recent Developments in British Water Works Practise," by special invitation of the association.

Under the general head of water purification were papers on experiences in the use of anthracite for filters, improved methods in rapid sand filter operation, and the Katadyn process (ionic silver dispersion). At the Superintendents' Session much interest and discussion were created by Superintendent Wardle's description of his experiences in operating a plant where water is free to all consumers (Hudson, N. Y.).

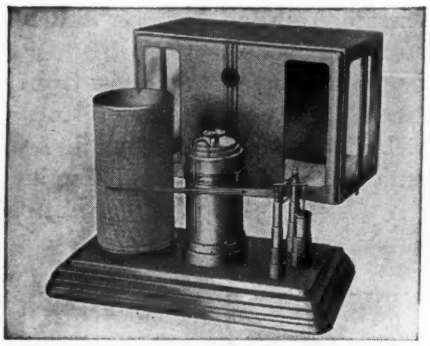
H. S. R. McCurdy, chief engineer of the Philadelphia Suburban Water Co., gave data and conclusions from the service operation of anthracite filters which were operated in parallel with similar filters in which sand was used at two plants operated by that company. The coal filters used less wash water, with runs averaging 78 and 87 hrs. compared to 56 and 64 hrs. respectively by the sand filters, with about the same efficiencies.

John R. Baylis gave suggestions for improving the operation of sand filters, especially for preventing or curing cracking and mud ball formation. Most of these troubles could, he believed, be prevented by careful gradation of the gravel during construction or reconstruction.

Mr. Gourley gave major prominence to underground water use and conservation in England. In discussing this, Malcolm Pirnie gave conclusions from extensive studies of ground water in Florida; among these being, that if less than 0.3 in. of rain fell in one storm it was all lost in evaporation, and unless at least 0.6 in. fell there was no addition to the ground water storage, and that therefore in Florida a large part of the relatively small rainfall of the dry season failed to give any increase to the ground water supply.

In Hudson, N. Y., the water supply and purification plant was built and is maintained by funds from the general treasury, and is not metered or charged for in any way. When unrestrained consumption (plus leakage) reached 140 gpd per capita and a danger point, a pitometer survey reduced this 25%; and a report that if it ever exceeds that amount an expenditure of $1,000,000 for a new supply would be necessary "threw a scare" into the consumer-taxpayers; but they are forgetting this and are again at the danger point. "Free water" was not recommended.

Regulation by water departments of water piping and fixtures in buildings was the subject of much discussion and varying opinions, from the positive opinion that these were private matters and none of the department's business, to one equally positive that such regulation saved trouble and money to both the consumer and the department and was a kindness if not a duty.



This Microbarograph makes a continuous charted record of variations in atmospheric pressure. The recording scale is expanded 2½ to 1; so that small variations are fully shown. The Microbarograph is invaluable for general scientific studies and also for modern methods of weather forecasting. For further information, write Julien P. Friez & Sons, Inc., Baltimore, Md.

Non-Skid Streets with Alundum Aggregate

Aluminum oxide abrasive, a material for making street and road surfaces non-skid, has been developed by the Norton Co., Worcester, Mass., manufacturers of porous plates for sewage treatment and of general abrasive products. It is of especial value in the wet fall months just ahead for treating such places as busy street intersections, stop and traffic lights crossings, grade crossings, steep intersections, and other places where sure traction is necessary under all weather conditions to prevent accidents.

Methods have been developed for using this aggregate with asphalt and tar surface treatments, with cold tar and asphalt applications, with concrete surfaces, with cement bound macadam, and with asphalt planking. The cost is not much, if any, in excess of usual methods of construction, since only about 2¼ pounds of the material is needed per square yard of surface. Details of the methods of application will be forwarded on request to the editor of Public Works or the Norton Co.

This aggregate is rust-proof, does not glaze under traffic, is unaffected by oils, fats, acids, freezing, moisture, etc. It apparently increases the wearing value of the road surface, also.

Various sizes of the aggregate are available for use to meet all highway construction conditions.

For Garbage Collection

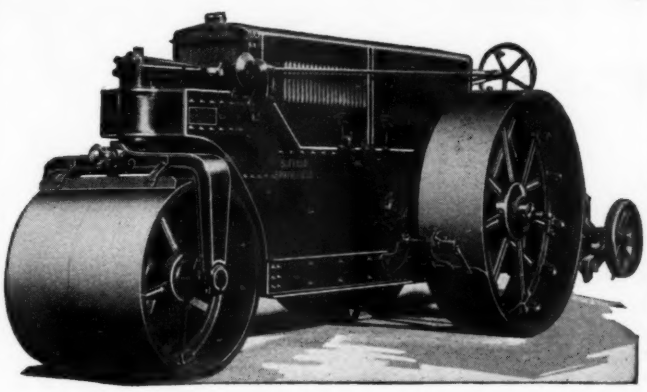
A new type garbage truck, designed by the Department of Sanitation, New York City, is unusual in several respects. It is entirely self-enclosed and is heavily insulated with rubber to reduce noise to a minimum. By using low-alloy, high-strength steel construction throughout, the weight of the truck has been considerably reduced. The truck has a capacity of twenty-two cubic yards and is equipped with a three-section hydraulic hoist.

Well Drilling Guide

An 80-page code and guide book on Wisconsin's administration of its new law providing for registration and regulation in well drilling. State residents having actual need of the publication may obtain a copy without charge by applying to the Division of Well Drilling Supervision, State Board of Health, at Madison. A number of illustrations prepared by Louis T. Watry, state well drilling supervisor, increase the usefulness of the publication by showing detail that might otherwise be obscure.

Dr. H. E. Tabler, Chairman of the Maryland Roads Commission, has been appointed chairman of the Committee on Safe Highways that is being organized by the ARBA.

W. H. Frazier, formerly sanitary engineer of the Indiana Division of Public Health, has been appointed assistant director of the Indiana State Board of Health.



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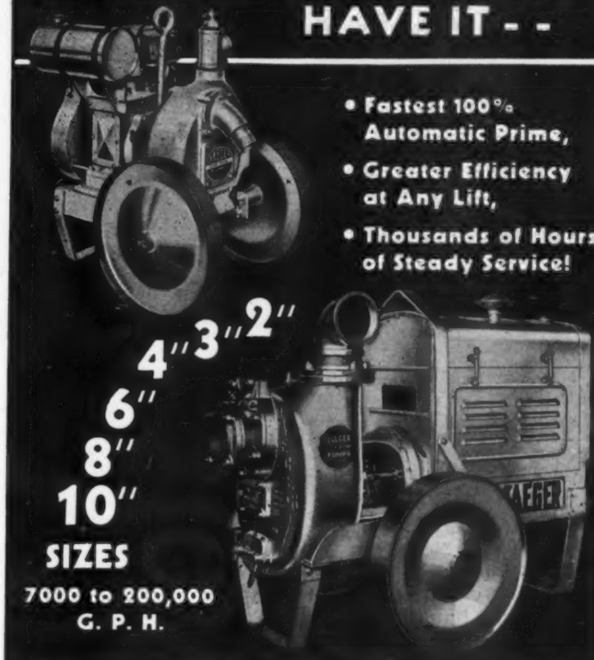

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This edition embodies all the more important information on the subject which has been made available up to this date by the investigations and experiences of the increasing number of able engineers and scientists who have specialized in this field.

There has been included in the section on sewerage some quite recent data relative to rainfall, anticipated population of cities, sewer design and related subjects.

Over 28,000 copies of "SEWERAGE" already sold make it the most popular book on the subject ever written. Mail check for your copy today—price only $4.50, postpaid. Money back in 10 days if not entirely satisfied.

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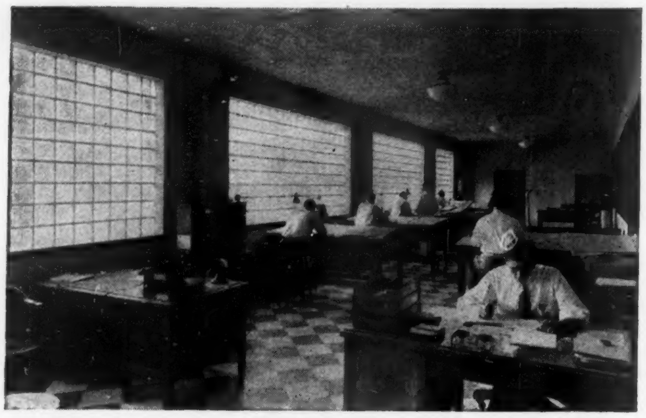
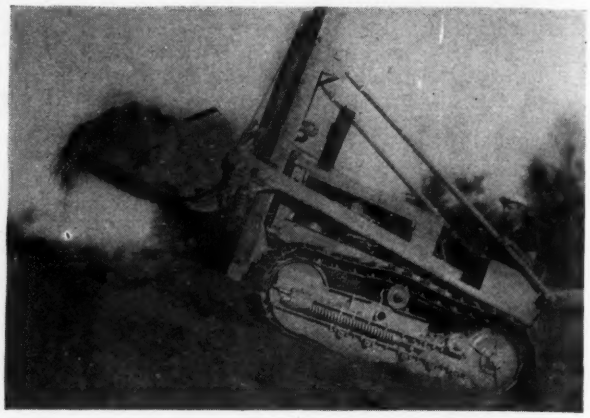


Drafting Room in New Jaeger Plant



The Hough Heavy Duty Tractor Shovel

The New Jaeger Plant

Completely insulated construction, year 'round air conditioning, sound proofing and the use of glass block windows, diffusing skylights and Venetian blinds for the scientific control of lighting are some of the features of the new general office building of The Jaeger Machine Co., manufacturers of construction and road machinery at Columbus, Ohio. According to O. G. Mandt, Vice-president and General Manager, expansion of the company's business, which in the first 8 months of 1936 has more than doubled the entire volume for 1935, made necessary this move. All offices have been located on one main floor, on the floor below is a 10,000 sq. ft. show room for displaying and demonstrating the company's products—pumps, mixers, hoists, truck mixers and road machinery.

Full automatic air conditioning, which controls both humidity and temperature, filters and completely changes the air throughout the building every three minutes. Executive offices are soundproof and specially insulated. Insulating glass block walls line the north and west sides, and the completely enclosed central general office is roofed with 480 sq. ft. of special skylight. A conference room for visitors is equipped for the projection of motion pictures taken on construction and paving jobs. It is stated that modern arrangement, equipment and attention to such factors as lighting and air conditioning have increased the efficiency of employees on routine operations as much as 30%. The company's former office building has been converted into shops and experimental plant.

New Heavy Duty Tractor Shovel

The Frank G. Hough Co. of Chicago, Ill., have brought out a new heavy duty hydraulic tractor shovel built especially for the special Allis-Chalmers Model "WM" Tractor. In cooperation with the Allis-Chalmers' engineers, the tractor and the shovel have been engineered as one complete unit. The complete assembled unit is shipped, ready for operation, from the Allis-Chalmers plant at Springfield, Ill.

The shovel has a one-half yard bucket and will dig any solid dirt or clay and raise the load sufficiently to dump seven feet from the ground. Thirty to forty yards an hour can be dug and loaded. Up to fifty yards of sand, stone, etc., can be loaded into trucks from stock pile.

This machine can be used by contractors, State, County or Township Highway Departments, Public Utilities, etc. The Tractor can, at all times, be used for regular drawbar work.

Mall Concrete Vibrator

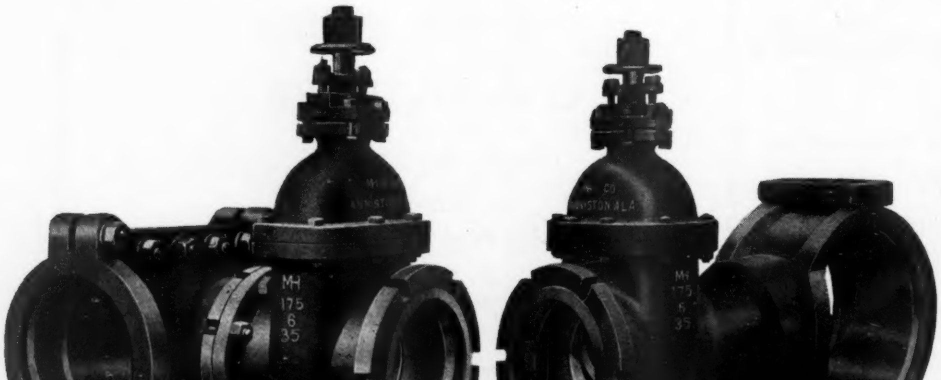
The Mall Tool Company, 7740 So. Chicago Ave., Chicago, Ill., has brought out a universal motor concrete vibrator. This vibrator is designed to operate from either 110 volt, A.C. or D.C. current, or 220 volt, A.C. or D.C. current, and delivers 9,000 vibration frequencies per minute. It is a lightweight unit—the power unit can be carried in one hand while the vibrator is operated by the other.

M & H Tapping Valves and Sleeves

Tapping valves and sleeves for use with any standard make tapping machine are shown in the accompanying illustrations. These are made by the M & H Valve & Fittings Co., Anniston, Ala., in sizes from 4x2 to 36x16 inches. They are of the double disc parallel seat type, conforming to the specifications of the American Water Works Association. Descriptions and specifications are contained in Pamphlet 33, which will be sent on request. This pamphlet also contains detail dimension data for all sizes.

Other waterworks products manufactured by this company include valves, hydrants and valve boxes, described in Pamphlet 31-S; this gives interesting information on how to install, repair, lengthen and use the compression type hydrant. Pamphlet 30 gives descriptions, data and complete dimensions of standard and extra heavy iron body gate valves, swing check valves, flanged fittings and flanges. This pamphlet contains 28 pages. Data and dimensions on cast iron bell and spigot fittings are given in Pamphlet 28, Underwriters iron body gate and swing check valves, and indicator posts for valves 2 to 12-inch are described in Pamphlet 29.

Any of these will be sent on request to M & H Valve & Fittings Co., Anniston, Ala.



M & H Tapping Valves and Sleeves

These booklets are FREE to readers of PUBLIC WORKS.

Readers' Service Department

CONTINUED FROM PAGE 60

sewer construction where replacement, repairs or reconstruction would be costly, cast iron pipe is most economical. For details, specifications, etc., write Thomas F. Wolfe, Cast Iron Pipe Research Ass'n. 1013 Peoples Gas Bldg., Chicago, Ill.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Glass Covers

393. Full details regarding the use of Lord & Burnham Glass-Overs at Middletown, N. Y.; Marion, Ohio; Cleveland, Ohio; Freeport, N. Y.; Kitchener, Canada; West Chester, Pa., and other places are given in bulletins 22 to 33. Sent promptly on request to Lord & Burnham Co., Irvington, N. Y.

Laboratory Equipment

400. The Phipps & Bird Stirrer, the solution feeder, a forthcoming stirrer using air for mixing, and all sorts of laboratory equipment for water and sewage plants. Bulletins and folders covering these pieces of equipment are complete and interesting. Phipps & Bird, Inc., 915 East Cary St., Richmond, Va.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Concrete

408. Concrete Pipe Sewers, a 28-page booklet, contains much valuable information and numerous illustrations on concrete pipe. Issued by American Concrete Pipe Association, 33 West Grand Ave., Chicago.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

412. How, when and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

413. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

415. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Rubber Lined Pipes and Pumps

418. New, 68-page catalog describes Ace rubber lined pipe and fittings, hard or soft rubber lined centrifugal pumps and Ace hard rubber double acting pumps, for chemicals used in treating sewage and water and for acids and other corrosive liquids. Contains illustrations and specifications. Issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Loughlin, self-cleaning travelling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of the "Straight-line Bar Screen" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

429. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

430. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Bed Glass Covers

432. Sludge Bed Glass Covers—"Super-Frame." Hitchings & Co., Elizabeth, N. J. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: **Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.**

Sludge Removal Equipment

442. If you are interested in economical sludge removal, write for the latest bulletin describing and illustrating Louden Monorail equipment which is adapted to open or closed beds. Full details sent promptly by the Louden Machinery Co., 400 West Ave., Fairfield, Iowa.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 247 Park Ave., **New York, N. Y.**

For the Engineer's Library

The editors will be glad to assist readers in getting copies of publications mentioned here.

Sludge Bed Covers:

This is a service sheet on Lord & Burnham glass enclosures for covering sludge drying beds. It contains a lot of information on design and also a set of specifications and drawings of standard units. Ask for Sheet 124-A from Lord & Burnham Co., Irvington, N. Y.

Barrett and Boulder:

Another booklet on Boulder Dam, and an unusually fine one. The Barrett Co., 40 Rector St., N. Y., has done its customary good job in telling of this interesting project. Barrett materials were used in a number of places. Sent on request—and worth it.

Adequate Street Lighting:

An 8-page publication on planning adequate street lighting, which should be helpful to the average engineer or technical official. Sent on request to General Electric Co., Schenectady, N. Y.

Highway Bonds:

Lawrence I. Hewes and James W. Glover have prepared a booklet on "Highway Bond Calculations," which has been published by the Department of Agriculture. It describes and gives the relative merits of sinking-fund, serial and annuity bonds, with examples and solutions. Several tables to seven decimal places are included. Send 10c to Superintendent of Documents, Government Printing Office, Washington, D. C.

Johns-Manville Products:

The 1936 edition of this catalog contains 60 pages and describes in considerable details the products of the company, including roofs, friction materials, conduits, pipes, packings and electrical materials; also building materials. Sent on request to Johns-Manvill Corp., 22 East 40th St., N. Y.

Catalogs and Booklets

A-6 Tractor:

A new catalog describing the Allis-Chalmers Model "L" tractor gives a lot of information and is generously illustrated. Write Allis-Chambers Mfg. Co., Milwaukee, Wisc., for free copy.

Tire Calculator:

For 1½ ton trucks; tell you what size of tire and what pressure to use for your loads. Works like a slide-rule; also a booklet with plenty of data, including a page of "Cost expectancy" tables. Sent on request to B. F. Goodrich Co., Akron, O., or get it from your Goodrich dealer.

A Slide Rule:

Kenneth Park, the slide rule designer of R. G. Le Tourneau, Inc., Peoria, Ill., has brought out another handy rule. This one should be of most value to dirt-movers. It computes the time cycle necessary by analyzing the factors that enter into this important item of dirt-moving costs. A rule will be sent free to anyone on request to Mr. Park at the above address.

Diesel Power unit, 6-cylinder, 80 h.p., is described in a 4-page booklet issued by International Harvester Co., 606 So. Michigan Ave., Chicago, Ill.

Excavator, Model 355, ¾-yard, shovel, dragline, crane, trench hoe, skimmer scoop and pile driver. 12 pp. Harnischfeger Corp., Milwaukee, Wisc.

Visible street markers; salient features are described and units illustrated; 4 pp. Traffic Equipment Corp., 557 W. 42nd St., New York, N. Y.

Road Graders, all sizes and types, are described in an excellent 16-page booklet, fully illustrated. Austin-Western Road Machinery Co., Aurora, Ill.

Roll-a-Plane roller for highway work; beautifully illustrated folder. Austin-Western Road Machinery Co., Aurora, Ill.

Resurfacing material, described in a folder. Mix this with cement, sand and stone for all sorts of repair jobs on floors and concrete. Flexrock Co., 800 No. Delaware Ave., Philadelphia, Pa.

Index to Advertisements